



Coronary Artery Disease and its Psychosocial Risk Factors: A Narrative Review

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doi: <https://doi.org/10.38179/ijcr.v2i1.59>

Abstract

Objective: Whenever the subject of coronary artery disease (CAD) and myocardial infarctions is discussed, the focus is usually shifted towards biological factors such as smoking, diabetes, or obesity; consequently, the management aims at addressing these factors. This paper approaches the subject from a psychosocial perspective and highlights the importance of these risk factors and their inclusion in CAD screening.

Background: CAD is one of the most common diseases worldwide and also one of the leading causes of death in multiple countries. Although we have a proper understanding of its pathogenesis and risk factors, we sometimes tend to overlook the psychological factors that affect the patient both pre- and post-diagnosis. The purpose of this paper is to present these underestimated factors and convey their importance.

Methods: To accomplish this, an extensive review of the literature was done using PubMed and Google Scholar, and articles were chosen based on the specified keywords. The references of these articles were also screened to identify more related studies and clinical trials.

Discussion: This paper is composed of multiple subsections that go over the epidemiology of the disease as well as its pathogenesis and known biological risk factors, before delving into the psychosocial aspects associated with CAD including the effects of depression, anxiety, social support, and sex differences on a patient's prognosis.

Conclusion: CAD is a disease for which the management is through multifactorial interventions. Although the pathogenesis is well understood, there is a clear gap when it comes to appreciating the patients' mental health when living with this diagnosis. Additionally, it has been shown that there is an increase in morbidity and mortality in the patients struggling on a psychosocial level, thus these factors should be included in the screening process.

Keywords: Coronary Artery Disease; CAD; Depression; Anxiety; Support; Mental health; Atherosclerosis; Pathogenesis; Plaques; SSRI; Management; Diabetes; Epidemiology; Prevalence; Prognosis; Myocardial Infarction; Personality; Type D; Hypertension; Phobia; Anger; Obesity; Stress; Psychological; Sex; Gender; Screening.

Received: 2020.02.28
Accepted: 2021.05.29
Published: 2021.09.01

Financial support: None
Conflict of interest: None
Patient Consent: Not Applicable
Ethical Approval: Not Required

Introduction

Coronary Artery Disease (CAD) or Coronary Heart Disease (CHD) falls under the category of cardiovascular disease and is associated with the formation of atherosclerotic plaques in the vessels of the heart. It can be asymptomatic until the patient presents with acute chest pain and other symptoms, such as in stable and unstable angina, all the way to non-ST elevation and ST elevation myocardial infarctions (MI) [1].

Most of the studies on CAD have focused more or less on the biological aspects and risk factors from diet and lifestyle. However, this article focuses on the psychosocial aspects of coronary artery disease in terms of the occurrence of the illness and overall prognosis of the patient. The paper will discuss various factors such as depression, anxiety, and social support and their impact on the patients' health and overall quality of life. Note that research is ongoing for behavioral modifications and improving the outcome of the patients [2].

Methods

The search was initiated on Google Scholar with specified keywords, which were expanded after a preliminary search was completed. Once more specific keywords were defined, they were looked up on PubMed, and peer-reviewed publications in English were selected. The references of the selected articles were also screened to identify further studies with pivotal results in highlighting the psychosocial aspects linked to the morbidity and mortality in CAD. Important articles were possibly missed, however, the articles selected were clear, concise, and yielded vital information with regards to the topic at hand.

Discussion

1) Epidemiology

In general, mortality from cardiovascular disease is very common worldwide with

CAD being one of the leading causes of death in first-world countries. Even though there has been a clear decline in mortality in western countries, largely attributed to the advancements in screening, therapies, and other preventive measures, CAD is still responsible for one-third of all deaths in those older than 35 years [1].

Taking a look at the United Kingdom from 1980 to 2013, there has been a sharp decline, of 68%, in mortality, yet, CAD remains the second leading cause of death in the country [1]. The prevalence of CAD has decreased from 1.74 million to 1.53 million between 1999 and 2007 and that number is still going downwards. The mortality itself has dropped by more than 70% in England, Wales, Scotland, and Northern Ireland between the years 1979 and 2013 [1]. However, since the disease can be asymptomatic for years and in its chronic state, this may affect prevalence measurements.

The NHS reports that between the years 2010/2011 and 2013/2014 male admissions for CHD has increased by 3000, whereas female admissions have decreased by 5000 [3].

Another country where cardiovascular diseases are very prominent is India, where they cause 17% of deaths and 32% of those deaths are in adults [4].

2) Pathogenesis

As mentioned before CHD can be asymptomatic for a long time, but it can eventually cause stable angina which presents as chest pain on exertion. It is well known that biological factors such as smoking, hypertension, and diabetes lead to the formation of plaques that obstruct the coronary arteries. However, an important point tends to be glossed over. Preceding the latter factors are emotional stressors working up at the level of the hypothalomo-pituitary axis (HPA) [5].

These emotional stressors come in different forms such as depression and anxiety, but they all work in a similar mechanism that involves exerting positive

feedback on the HPA. This creates a large response from the sympathetic nervous system resulting in a plethora of effects such as hypertension, inflammation, and platelet dysfunction. High levels of cortisol are also released, which suppress growth and sex hormones, thus promoting obesity and insulin resistance [5].

Because of this, screening and management of CHD should take into consideration the mental well-being of the individual and cardiologists should be vigilant for these psychological implications when assessing new patients and overall risk.

3) Depression

Depression is one of the most common psychiatric illnesses, affecting millions of people worldwide. The word “depression” itself covers a wide range of disorders outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM) that differ in intensity and duration of the individual’s low mood [6].

Multiple studies have shown that the presence of any of these disorders is associated with an increased incidence of CHD and vice versa. This strong relationship between the two distresses the individual and leads to an overall increase in morbidity and mortality [7].

One such study is a meta-analysis by Van Melle et al. in 2004 that showed that post-MI, depression is associated with a 2 to 2.5 fold increase in developing another cardiac event. This analysis also points out that there was a stronger correlation between depression and cardiac events in studies done in the 90s as compared with those in the 2000s [8].

Bush et al. (2005) stated that up to 20% of CHD patients meet the criteria for depression and 47% of CHD patients have reported depressive symptoms after discharge [9].

Similar findings were found in another report a few years later in 2008, where up to 35%-45% of people who have had a myocardial infarction showed some

degree of depression, soon after affecting their quality of life and their ability to adapt to various lifestyle changes [10].

A study by May et al. (2017) expanded on the relationship as well. This large study showed that, among the people with CAD who died, 50% had depression as opposed to 38% who did not. They also urged the inclusion of depression as part of the CAD prognosis screening [7].

The category of depression most correlated with CHD is Major Depressive Disorder (MDD). MDD is characterized by significant loss of interest and pleasure in daily activities, as well as loss of appetite and sleep among other symptoms [6].

MDD, and the other subcategories of depression, affect the body by a variety of mechanisms including increased platelet reactivity and inflammation. A marked increase in pro-inflammatory markers such as C-reactive protein (CRP) and cytokines with a decrease in anti-inflammatory markers is observed. Furthermore, there is an elevation of sympathetic nervous system activity accompanied by an increase in, what is usually described as, stress hormones. These include catecholamines, adreno-corticotrophic hormone (ACTH), and both cortisol and urinary cortisol [6].

However, medication still has a role to play in placing a barrier between CHD and depression and providing the individual with some relief. This was proven in a recent study by Fernandes et al. (2020) whose results showed that Selective serotonin reuptake inhibitors (SSRIs) have a role in reducing myocardial infarctions in CAD patients by 44% and improving quality of life even though the mortality rate remained the same [11].

4) Anxiety

Another very commonly diagnosed psychiatric illness is anxiety which, in the US alone, composes a third of the expenses for mental illness [12]. When compared to men, women exhibit a higher lifetime prevalence of 30.5% as opposed

to 19.2% in the former. A 12-month prevalence of 17.7% in the general population is also reported [13].

Much like depression, anxiety and its connection to CHD have been extensively studied over the years and a clear link has been established in numerous studies.

One such study was conducted by Frasure Smith et al. (2000). They reported that over 40% of patients with stable CHD have elevated anxiety symptoms. This same study reports a 2.3 fold increase in the risk of cardiac events 2 months after discharge for generalized anxiety disorder (GAD) patients [16].

Similar findings were also published by Tully et al. (2013). Their large meta-analysis concluded that 11-14% of cardiac patients have GAD [15].

A recent study conducted by Sharma et al. (2018) yielded interesting results. Instead of focusing on connecting anxiety and CHD, they looked deeper and they found that anxiety post-CAD diagnosis was more common in women and possibly linked to gender roles or discrimination, but they also acknowledged the role of financial stability and social status in the equation [14]. The psychological differences between men and women will be elaborated on further below.

Physiologically speaking, and as previously mentioned, the emotional stressors follow the same pathway. Anxiety is no different. These pathways, however, are not always evident and clear and are constantly reviewed. Some studies such as the meta-analysis conducted by Chalmers et al., report a reduction in heart rate variability among GAD patients with CHD. Furthermore, and similarly to what was mentioned in depression before, the over-activation of central and peripheral nervous systems with their related hormone releases in response to social events increases inflammation and subsequently the likelihood of cardiac events [17].

Similarly to depression, the treatment for

anxiety involves the use of barbiturates, benzodiazepines, tricyclic antidepressants, SSRIs, and selective norepinephrine reuptake inhibitors (SNRI). [18]. However, many studies have shown that there is no significant correlation between these medications and a reduction in future cardiac events [12].

5) Social Support

As previously mentioned, both anxiety and depression can be treated medically with anti-depressants. This, however, is not the only management. Research has shown that social support provided to the patients, whether it comes from family or friends, can be increasingly beneficial and associated with a better outcome overall.

Social support comes in different forms such as emotional or financial. It revolves around the concept of “being there” for the individual and not letting them succumb to negative emotions.

Lett et al. (2005), for instance, concluded from their study that a low amount of social support is associated with an increased risk of cardiac events of around 1.5 to 2 fold in both the healthy population and in CAD patients. However, their study highlighted that there is a considerable difference when it comes to how social support is provided and which type of support has a more beneficial effect on the patients. It was also difficult to quantify support and what certain people may deem enough, others may not [19].

On a related note, the evidence collected in various settings consistently showed a strong, negative correlation between the degree of depressive symptoms and the support provided.

To illustrate this point, a study by Frasure-Smith et al. (2000) was performed and the results were as follows. The patients who suffer from depression were more likely to die of CHD, however, this was not true for those with perceived high levels of support. The keyword here is “perceived”. Depressed patients who have social support did not always see it as such and

were less likely to have close friends, which can possibly explain why the overall rate of depression remained high [16].

However, lack of perceived support was not always the issue. For instance, Coyce et al. (1976) noted that patients with low or absent support had sometimes alienated the people who were trying to offer it in the beginning leading to self-induced loneliness [20]. This loneliness itself was associated with an increased risk of CHD events among women more than men and these rates warrant clinical attention as was shown by Thurston et al. (2009) [21]. Similar results were found by Wang et al. (2005) who found that an accelerated development of CAD in middle-aged women is associated with an absence of emotional support and deep, personal relations as well as social isolation [22].

To further support this, Shen et al. (2004) found that patients who were optimistic and were well supported in society had good health outcomes, and also were less likely to engage in detrimental coping [23].

All in all the research proved that social support is a vital prognostic indicator and may even be as crucial as biologic factors.

6) Personality

Whether the individual perceives the support around them and how they view their situation, in general, is strongly determined by their personality and attitude. The role that personality traits can play should not be neglected when it comes to coronary artery disease for they can have a direct and indirect contribution by physiological mechanisms and unhealthy lifestyles respectively. When it comes to coronary artery diseases two personality types are often mentioned; Type A and Type D.

Type A is a behavior pattern characterized by impatience, time urgency, hostility, and aggressiveness. It has been reported to be associated with coronary artery disease since the 1950s [24].

Anger is a major component of Type A and is associated with increased CHD events

in a healthy population with more men being affected than women. It is also associated with poor prognosis. These findings support the use of psychological management focusing on anger management [25]. On the other hand, various other studies have also shown that there was no significant correlation between type A and CHD [26].

Patients with type D personality exhibit negative emotions and suppress their expression at the same time. This has dire consequences as it has been shown to increase the susceptibility to cardiac events and significant emotional distress [27].

When looking at type D, a study by Denollet et al. (2000), which examined the 5-year prognosis of 319 patients with CHD showed that the subsequent cardiac events occurring were indeed related to patients with Type D personality, as well as other factors such as low ventricular ejection fraction, age, and low exercise tolerance [28].

Schiffer et al. (2007) found that type D patients with CAD were much less likely to report certain symptoms such as edematous legs and feet or shortness of breath, though this does not mean that they don't exhibit them. It was found that they experienced more symptoms than other patients, but due to their social inhibition, they chose not to report them. This character may also develop into depression leading to the aforementioned consequences [29].

Several studies have shown that it is possible to predict the likely outcome of a patient who suffered an acute coronary syndrome or has CAD if they have a type D personality. The latter is also associated with elevated inflammatory markers especially cytokines in heart failure and with disturbances in cortisol secretion [30].

7) Gender differences

While the personality types discussed apply to both men and women, there are significant differences when looking at

men and women and the occurrence of CHD.

From an epidemiological point of view, the prevalence of CHD is higher in men within each age group right up until the age of 75 where it becomes higher in females. Biological differences play a role, but this is also because the female sex is associated with a longer life expectancy and so there is a higher prevalence of various cardiovascular diseases including CHD in the elderly [31].

Women with CHD are in general older than men and even though both of them share the same risk factors, the degree to which each factor affects the individual is different between the sexes [32].

As mentioned previously [13, 14], women can experience just as much anxiety and stress as men if not more. This predisposes them to develop CHD in the future and yet the risk is often downplayed and this has been linked to ongoing social bias and discrimination [33].

The reason for this bias is that CHD is still considered to be a “men’s disease” to some people because women are more or less biologically protected against it for most of their lives. While there is truth to that statement, it most certainly does not mean that women are immune to CHD. Unfortunately, many women who fall under this illusion themselves delay seeking help when they start experiencing symptoms further increasing complications.

Yet, it is not always in their own hands. Over the years, research has shown that women were less likely to be referred to cardiologists or for certain procedures because of this bias. This leads to higher MI death rates in young women as compared to men [33]. One particular study found that women who do present with cardiac symptoms such as high blood pressure or elevated heart rate are more likely to be prescribed anxiolytics as opposed to anti-hypertensives or anti-arrhythmic medications [34].

Working women, in particular, can be

under both work stress and emotional stress, which increases their CHD risk [35].

On the other hand, when it comes to men a majority have adapted to a way of life that involves denying depression or downplaying stressful life events because it was not deemed “manly” to do so. This can manifest harmfully and ultimately can lead to heart disease [36]. Single men were found to be especially more vulnerable [37].

8) Stress

The emotional stress that both men and women can experience before eventually developing CHD is not to be taken lightly. The same can also be said about work stress which is also a key factor in heart disease.

Many studies have shown a link between various types of stress and eventual CHD. One of these studies was that of Kivimaki et al. (2015) [38] who reported that there is a link between stress and metabolic syndrome (obesity, hypertension, and hyperglycemia). This study also mentioned what is known as iso-strain, which is the combination of work stress and low social support which is associated with metabolic syndrome. In this same study, metabolic syndrome explained approximately 15% of associations between iso-strain and CHD. Furthermore, they reported that differences between men and women, young or old, and different socioeconomic backgrounds were small and not significant and results were similar [38].

In addition to the latter stressors, it is important to note that the stressed patients tend to be less physically active and more prone to an unhealthy lifestyle, which consequently leads to a higher rate of hypertension and hypercholesterolemia as opposed to others who are not under any work stress [39].

Similarly, Steptoe et al. (2012) noted that employees who experience work-related stress along with social isolation are at an increased risk of the first event of CHD.

Furthermore, short-term emotional stress can be the trigger for other cardiac events in people who are susceptible or already have advanced atherosclerosis [40].

Certain “life stressors” can also trigger CHD events but these are more difficult to study as they are great in number and affect people differently. Certain life events such as bereavement or catastrophic ones such as an earthquake or terrorist attack are all examples of life stressors [41].

One much-overlooked factor is the stress that comes with mental diseases such as schizophrenia and bipolar disorder which also impose a large amount of stress on the individual, further increasing morbidity by raising the cortisol levels in the body and stimulating the production of atherosclerotic plaques [42].

The absence [16, 22] or presence [14] of social support plays a large role in how severe the different stressors will be on the affected individual.

9) Anger and hostility

Anger is the emotion that often precedes stress. It is inevitable and every person experiences a substantial degree of anger in their lifetime. Because of this, one could conclude that there is an association between anger and CAD since it can precipitate the aforementioned risk factors. This, however, is not the case. It is a controversial point and numerous studies have shown very different conclusions.

Studies conducted in the 90s and early 2000s showed positive correlations between anger, hostility, and eventual CAD. One study by Matsumoto et al. (1993) proved a relation between rage and plaque formation [43]. Another study in 1994 concluded that a person’s cynicism would eventually result in them losing trust in others and consequently isolating themselves. This would further worsen their health [44].

In more recent years, analyses tend to disprove the latter or diminish any strong correlation. A meta-analysis by Chen et al.

(2019) illustrated this [45] by showing no evident link between anger and CHD or stroke.

In 2020, Sadeghi et al. found similar results. However, they acknowledged the limitations of their study especially due to their sample size. Furthermore, they emphasized that different personalities respond to anger in different ways and manage it differently. This would decrease the level of stress and prevent eventual plaque formation [46].

Research is ongoing on this particular risk factor because of the diverse conclusions, but most researchers agree that anger has a part to play, but perhaps not a large one.

10) Panic disorder (PD) and post-traumatic stress disorder (PTSD)

Panic disorder is characterized by repeated attacks of fear that can come on at any time and can be unprovoked. The symptoms of panic disorder are similar to those of CAD. These include chest tightness, chest pain, and palpitations. Cardiologists must be vigilant when taking a medical history to form a more accurate diagnosis.

Numerous studies have found evidence that PD can be a predecessor to cardiac events. Caldirola et al. (2016) found an increase in arrhythmias and cardiomyopathies in patients with PD [47]. Similarly, another study investigated the relationship between PD and atrial fibrillation and found an increased incidence of the latter in patients with known PD. This would likely predispose to CAD in the long term if not managed or if the individual does not have a strong support system [48].

Kokacya et al. conducted an interesting study in 2015 with a different approach. They investigated the relationship between platelet activation and panic disorder. The results of their study showed higher levels of platelets in patients with PD as opposed to those who without. These elevated platelet levels predispose patients to more CVD events [49].

Similar to PD, PTSD has also been associated with increased cardiac events especially among war veterans or victims of sexual assault. These individuals were shown to have hypertension and tachycardia. Evidence also suggested an increase in cholesterol levels and inflammatory markers in these individuals, which further encourages plaque formation [50].

PTSD can also be a strong predictor of mortality from CAD [51].

Limitations

Given the methods used to write this paper, it is likely that some psychological risk factors, were missed as well as relevant articles and studies. As this is a narrative review going over multiple resources, some important points may also have been glossed over within those same articles.

Conclusion

Anxiety and depression are only some of the common psychiatric conditions in both general populations and individuals suffering from Acute Coronary Syndromes and MI, and as shown in this article, there are multiple factors at play other than biological health and diet. An individual's mental health, gender, and even the amount of social support that one has, can have a drastic effect on the prognosis and should be included in the screening process.

More research is needed to better understand the proposed pathological mechanism at work, as doing so may influence and improve the treatment of these psychosocial aspects in the context of Coronary Artery Disease.

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