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Review Article

Ayurvedic approaches for the prevention and treatment of coronary artery disease: Moving from theory to clinical practice

Ashok Kumar Panda[1]*, S Kar[2]

[1]Research Officer, Regional Ayurveda Research Institute, Ahmedabad, Gujarat, India.
[2]JSS Ayurveda Medical College, Mysore, Karnataka, India.

Abstract

The incidence and mortality rates of coronary artery disease (CAD) are rising in India, with a significant shift towards younger population in between the age of 30 to 60 years. Ayurveda classical texts described Hrudroga (heart disease) and Hrudshoola (angina) as a sudden, sharp pain occurring in the heart region based on tridosha theory. Actually hrudshoola (Angina) is a symptom of CAD and Vata, Kapha and Meda dhatu (adipose tissue) involved in pathogenesis of CAD. Hridya mohakasaya of Charak Samhita was ignored and the food, beverage, fruits and vegetables described in Ayurveda were remains as theory for practitioners. The most used Ayurvedic bio active molecules of cardiac medical plants like- Arjuna, Lasuna, Sarpagandha, Daruharidra, Garcinia, Curcumin etc are cardioprotective in terms of Pharmacological study and clinical trials for CAD. The Ayurveda formulations described different texts were in ambiguous practice in past. The patients were also generally hesitant to seek heart disease treatment from Vaidyas, Ayurvedic physicians were only focused on classical theoretical knowledge rather than modern understanding of heart diseases and clinical practice. In recent times, Ayurvedic medicines are gaining attention as potential adjunct therapies, particularly for their roles in alleviating angina, offering lipid-lowering effects, and providing anti-thrombotic benefits. These therapeutic approaches could complement to standard treatments, potentially enhancing symptom relief and improving overall survival outcomes of CAD. Ayurveda can also independently reverse coronary architecture of stable angina, completely eliminate the need for preventive modern medications in some cases. Arjuna (Arjuna (Terminalia arjuna) preparations are found best in CAD. So Ayurvedic strategies for the prevention and management of coronary artery disease (CAD) have transitioned from classical theoretical foundations to implementation in clinical settings, but more enthusiastic and dedicated Ayurveda scholars should come forward to create more evidences.

Keywords: Coronary artery disease (CAD), Coronary Heart disease (CHD, Ischemic heart disease(IHD), Chronic Coronary diseases, Hridya mohakasaya, Cardio tonic.
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1. Introduction

Coronary artery disease (CAD), also referred to as coronary heart disease (CHD) or ischemic heart disease (IHD), is characterized by the narrowing or obstruction of the coronary arteries—vessels responsible for supplying oxygen-rich blood to the myocardium. This compromised blood flow can result in myocardial ischemia and subsequent cardiac tissue damage. The code as per International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) this disease comes under 125.0 to 125.12.

The incidence and mortality rates of coronary artery disease (CAD) has been on the rise in India after post COVID -19 pandemic period and it is about 7 to 13% with a high incidence in urban areas and more young people are effected.[1]

Epidemiologic studies have shown that there are at present over 30 million cases of CHD/CAD/CCD(Chronic Coronary diseases) in this country. Moreover, it effects on the productive workforce aged 30–65 years. Acute coronary syndrome include unstable angina with myocardial infraction can be diagnosed through symptom, ECG, and cardiac bio

*Corresponding author: Ashok Kumar Panda
Email: akpanda_06@yahoo.co.in

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marker level. Chronic coronary syndromes (CCS), in the past recognized as stable CAD, is a clinical entity characterized by a chronic or repetitive mismatch between supply and demand of myocardial oxygen. This includes patients with suspected CAD and either "stable" anginal symptoms/dyspnoea, or with new onset of heart failure (HF) or left ventricular (LV) dysfunction, and patients with stabilized symptoms < 1 year after an ACS or recent revascularization.[2] Coronary Computed Tomography Angiography (CCTA) is a popular non-invasive imaging technique used to diagnose coronary artery disease (CAD) by visualizing the coronary arteries. It offers relatively high sensitivity and specificity for identifying CAD and can be particularly useful for non-cardiologists due to its ease of interpretation and wider availability compared to invasive procedures like coronary angiography. CCTA is a 3D imaging test that uses X-rays and computer technology to create detailed images of the heart and its blood vessels. Coronary Artery Disease (CAD) can be classified based on the severity of coronary artery blockage, which is measured as the percentage of the artery's diameter narrowed by plaque.[3] CAD is typically categorized as follows: Obstructive (over 50% blockage), non-obstructive (less than 50% blockage), Mild (20-40% blockage), Moderate (40-70% blockage), and Severe (over 70% blockage). Nonobstructive CAD can be progressed to obstructive CAD within one year and both are associated with increasing rates of MI and all-cause mortality. Overall, CAD is responsible for 20% of deaths in the developed world.[4]

Consequently, high costs are associated with the clinical assessment of affected patients and, therefore, healthcare systems and providers face significant challenges in managing CAD. In this sense, promoting Ayurveda therapies is very crucial for its prevention and treatment, which must be based on robust scientific evidence to improving patient outcomes as per Atal Integration Scheme of Niti Aayog.[5] However, in my experience, it is very difficult to identify the patients who would truly benefit from Ayurveda therapies, thereby avoiding unnecessary polypharmacy. Moreover, Coronary artery disease (CAD) can lead to several complications, including heart failure, arrhythmias, heart attacks and sudden cardiac death.

The primary treatments for coronary heart disease include percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG), and the long-term administration of anticoagulant, antiplatelet, and lipid-lowering medications. However, these conventional interventions may lead to complications such as neovascularization, plaque reformation, vascular restenosis, and systemic toxicity associated with prolonged drug use. Ayurveda shows promise as an adjuvant therapy for coronary artery disease (CAD), owing to its favourable safety profile and pleiotropic effects, including anti-inflammatory, antiplatelet, lipid-regulating, endothelial-protective, and microcirculation-enhancing actions. In recent years, the exploration of Ayurvedic approaches for the prevention and treatment of CAD has progressed from theoretical frameworks described in Classical Ayurveda texts to clinical application.[6]

2. Pathophysiology of Coronary Artery Diseases

Coronary arteries are branch off from the aorta and supply blood to all parts of the heart. Two main coronary arteries are the left and right coronary arteries. The left coronary artery (LCA) further divides into the left anterior descending (LAD) and left circumflex arteries(LCX). Right coronary artery blood (RCA) supply to the right ventricle, the right atrium, and the SA (sinoatrial) and AV (atrioventricular) nodes. These nodes control the heart rhythm. The right coronary artery divides into smaller branches. One is the right posterior descending artery and acute marginal artery send blood to the middle (septum) of the heart. Coronary arteries innermost layer is the tunica intima. This layer is lined by endothelium; middle layer is tunica media where smooth muscle fitted with alpha- and beta-adrenergic receptors and outer layer is Tunica externa that composed of type I collagen and elastic connective tissue.[7]

Coronary blood flow dynamics is regulated or influenced by factors like myocardial oxygen demand, arterial pressure, neural and hormonal factors, and local metabolic conditions. Endothelium cells (EC) is a single layer cells representing the first barrier for molecules, cells, or pathogens circulating in the bloodstream and working as a sensor and transducer of signals produced by biologically active substances. Endothelial dysfunction is the 1st step of atherosclerosis where ECs lose their ability to maintain homeostasis, vessel walls are predisposed to vasoconstriction, lipid infiltration, leukocyte adhesion, platelet activation, and oxidative stress, among other things. Hemodynamic forces constitute a local risk factor of atherogenesis, as they promote endothelial dysfunction. Endothelial dysfunction caused by a variety of factors, including high blood pressure (hypertension), diabetes, smoking, obesity, high cholesterol, and genetic predispositions The lesion-prone regions are mainly located in areas where the laminar flow is disturbed and turbulent flow is more with lower shear stress. Accumulation of Low density Lipoprotein (LDL) in circulating plasma favors trans-endothelial infiltration of circulating LDLs to the intima. Oxidized LDLs are key inflammatory components that promote atheroma plaques development, as they contain oxidized lipids and products derived from their degradation that contribute to the physiopathology of the disease. Atherosclerosis is a disease condition where calcium phosphate is deposited in atheroma plaques, a process known as calcification. This calcification is a key part of the progression of atherosclerosis, leading to hardening and narrowing of the arteries.[8] The regression of atheroma plaques can be easy through Ayurveda intervention but difficult after calcification.

3. Risk assessment of Coronary Artery Diseases

In contrast to many other disease processes, the onset and progression of coronary artery disease (CAD) can be significantly reduced by effectively managing cardiovascular risk factors such as smoking, poor diet and physical inactivity, high blood pressure, diabetes, and abnormal cholesterol levels. Non-modifiable risk factors include age, gender, ethnicity, and family history of CAD. Modifiable risk factors include hypertension, hyperlipidemia, diabetes, obesity, smoking, poor diet, sedentary lifestyle, and stress. Therefore, Health care provider should recognise the cardiac health risk factors and its assessment. Various tools have been developed to assist physicians, among Framingham CVD risk score, the Reynolds risk score, and the QRISK3 assessment, all of which can be used to estimate the future risk of a cardiac event) are popular and it categorised the patients to mild, intermediate and high risk group for risk factor modification by *dinacharya*, *ritu charya*, diet, exercise, Yoga, *Panchakarma* and Ayurveda medicines. The ASCVD (atherosclerotic cardiovascular disease) risk score is a national guideline developed by the American College of Cardiology. It is a calculation of your 10-year risk of having a cardiovascular problem, such as a heart attack or stroke. This risk estimate considers age, sex, race, cholesterol levels, blood pressure, medication use, diabetic status, and smoking status.[9]

4. Ayurvedic Understanding of Hrud Roga (Cardiac diseases)

Ayurveda promotes a holistic way of life and treatment, grounded in principles such as Panchamahabhuta (the five great elements), the concepts of Dosha, Dhatu, and Mala, as well as the Samanya-Vishesha theory. Most diseases in Ayurveda are classified symptomatically according to the Tridosha theory—Vata, Pitta, and Kapha. However, Hrudroga (heart disease) is an exception, as it is categorized based on the anatomical structure of the body. In this context, Hrudshoola (angina) is described as a sudden, sharp pain occurring in the heart region. Hrudroga is five types based on tridosa and all mixed dosa (Sannnipata) and krimija (infective). It is very interesting to note that the aetiologies of Hrudroga are cinta(stress), trasa(harassment) etc, vitiation of Rasa dhatu (digestive fluid) and adhyasana (repeated eating) of guru aharav (heavy food like -meat, milk shake etc), but not snigdha (ghee), rather ghee preparations are described in Hrudroga management. Ayurvedic Alcoholic preparation (Madhya) is good for heart, i.e. Hridya (Heart tonic), but if alcohol produce Mada (Intoxication) then produce Heart diseases. Hrudshoola (angina) is matter of discussion in CAD, Susruta described as Kaphaja shola, whereas Madav nidan described as Vataja Shoola , it can be summarised from our practice as Kaphaja hrudshoola found in Obese patients whereas Vataja hrudshoola found in Lean patients.[10] Actually Hrudshoola(Angina) is a symptom of CAD and vata, Kapha and Meda involved in pathogenesis of CAD.

Ayurveda's objectives prevent fast and treat all diseases. Ayurveda described about Hridya mohakasaya (**Table 3**) and food, beverage, fruit, vegetable and medicine beneficial for cardiac wellness (**Table 4**Table no-4) and prevention. Arjuna (Terminalia arjuna) is miracle plant used all kinds of heart diseases.[11-14] Ahrudya are food beverages and medicinal plants are not avoided in cardiac diseases or cardiotoxic.

5. Prevention of Coronary Artery Diseases

In the past, patients were generally hesitant to seek heart disease treatment from *Vaidya*, Ayurvedic physicians were also focused on classical theoretical knowledge rather than modern understanding of heart diseases and clinical practice. But recent days, the incidences of CAD patients are increasing in Ayurveda hospital and clinics which reflects the positive awareness of Ayurveda, integrative approach, collective clinical evidences and broader public health challenge of managing cardiovascular disease. Three categories of patients usually seek Ayurveda treatment for CAD/ CCA i.e, the individuals at risk but without established disease are seek primary preventive measures, 2nd category is Individual having h/o CVD events with multiple coronary blockages recommended for open heart surgery, want to avoid coronary artery bypass graft (CABG) and 3rd category patients of chronic Coronary Diseases (CCD) want to avoid on going secondary prevention modern statin, beta blocker and Aspirin, etc.[15] and to excepting reversal of coronary atherosclerosis, heart failure and improve arterial architecture. The primary and secondary prevention can be achieved through Ayurveda by adopting *Ahara* (diet) and Vihar that includes *Vyayaman* (exercise), *Vyasana parihara* (Avoid addiction) etc . Panchakarma (detox therapy), avoid *vega dharana*(natural urges) and *nitya hridya dravya sevan* (the food, beverage, fruit, vegetable and medicine beneficial for cardiac wellness) are also important for prevention of CAD.[16]

A. ***Ahara (Diet)***- Diet is as important as medicine in Ayurveda. Assessment of a dietary pattern with high intake of vegetables, fruits, herbs, nuts, beans, and whole grains, is associated with decrease in blood pressure of 6 to 7/2 to 3 mm Hg in middle-aged and elderly adults with type 2 diabetes or three CVD risk factors. This diet did show improvement in serum low-density lipoprotein (LDL), high-density lipoprotein (HDL), or triglyceride levels. The Hridya Dravya used as grain , beverage , fruits and vegetable described in Ayurveda text can be used (**Table 1**), The *Hridaya mohakasaya* can be used daily to reduce cholesterol and inflammation.[17] *Ahridya dravya* (not good for heart) like-Maduka(Madhuka indica), *avidugdha* (sheep milk) ,*jeerna madya* (toxicities alcohol) should also be avoided. Emphasize intake of vegetables, fruits, legumes, nuts, whole grains, and fish, and minimize the intake of sweetened beverages, refined carbohydrates, and processed meats.

Table 1: ASCVD (Atherosclerotic cardiovascular disease) risk enhancer

S. N	ASCVD risk enhancers
1	Family history of early-onset ASCVD< 60year
2	Smoking and high alcohol use
3	Continually elevated LDL greater than or equal to 160 mg /dL (≥ 4.1 mmol/L)
4	High Blood pressure
5	High BMI/ central obesity
6	Chronic kidney disease
7	Metabolic syndrome Diabetic / MALD
8	Preeclampsia or premature menopause ·
9.	Continually elevated triglycerides greater than or equal to 175 mg /dL (≥ 2.0 mmol/L)
10	Inflammatory diseases such as rheumatoid arthritis, psoriasis, or HIV ·
11	Severe mental illness or anti-psychotic therapy
12	Erectile dysfunction
11	Routine use of steroid
12	High sensitivity C-reactive protein

Table 2: Hridya Dravya: The food, beverage, fruit, vegetable and medicine beneficial for cardiac wellness described in Ayurveda

Food grain	Beverage	Fruits	Vegetable	Ayurvedic Drug
Rakta Shali Red rice)	Taya (purified water)	Dalima Punica granatum L	Patala Trichosanthes dioica	Tambula Piper betle
Yava dhanya (Barley)	Takra (Butter milk)	Amra Mangifera indica	Kusmanda Benincasa hispida	Nagara Zingiber officinalis
Priyangu (Millete)	Narikela udaka (Coconut water)	Amalaki Phyllanthus emblica	Jeevanti saka	Katuki Picrorhia kurroa
Laja Dried Rice	Kharjuramadya (Alcoholic prepared from Pamb)	Sitaphala Annona squamosa	Kokilashya saka Hygrophila auriculata	Lasuna Garlic
Koda Koda Millete	Sarkara sidhu (Alcohol from cane sugar	Amrataka Spondias pinnata (Linn. f.)	Changeri saka Oxis comiculata	Maricha Piper nigrum
	Sukta (alcohol from rice)	Kharjura Vitis vinifera	Vitphala Ridge guard	Pippali Piper longum
	Rasala (Mango juice)	Drakshya Vitis vinifera	Kakamachi Solalum nigrum	Arjuna Terminalia arjuna
	Potala soup	Matulingo Citrus medica	Punnava Boerhvia diffusa	Rudrakshya
	Mudga Jusa	Amla vetasa Garcinia pendunculata	Lauki Lagenaria siceraria	Mukta, Swarna, hiraka Bhasma
	Gomuta (Cow urine)	All Berries	Sigru Drum stick	Swarna (Gold Bhasma)
	Mruga mamsa (deer meat)	Papaya, water milon, Peruka (Guava)	Kadali Green banna	Abhra Bhasma

Table 3: Hridya Mohakasaya described in Charak Samhita with cardiotonic evidence

S. N.	Sanskrite Name & English name	Mechanism of action
1	Aama(Mango)	Antioxidant
2	Amaratak (Wild mango)	Antioxidant
3	Lakoooch(Monkey Jack)	Antioxidant
4	Karamarda (Begal currant)	Antioxidant
5	Vrishyamla (Malabar tamarind)	Anti lipidemic
6	Amlavetash (Wild Mangosteen)	Anti lipidemic
7	Kuval Plum)	Antioxidant
8	Badar(Ber)	Antioxidant

9	Dalima (Pomegranate)	Antioxidant
10	Matulunga (Wild lemon)	Antioxidant

Table 4: Ayurveda herbs in coronary artery diseases and its mechanism of Action[30-34]

S.N	Ayurveda Medicinal Plant	Mechanism of action
1	Arjuna Terminalia arjuna	increasing left ventricular ejection fraction, decreasing heart volume, decreases LDL , and enhancing myocardial contractility
2	Sarpagandha Rauvolfia serpentina	Anti-hypertensive and anti hyperlipidaemic[34]
3	Lasuna Allium sativum	beneficial effect on lowering blood pressure, reducing blood levels of cholesterol and triglycerides, and inhibiting platelet aggregation
4	Haridra Curcuma longa	reducing inflammation, lowering cholesterol, and potentially aiding in heart failure
5	Daruharidra Berberis aristata	Berberine improving endothelial dysfunction, anti arrthymic effect, lower blood pressure,
6	Kurubaka Rhododendron arboreum Sm	Rhododendron arborium Sm flowers and its n-butanol fraction has good cardio-protective effect
7	Vetasamla Hippophae rhamnoides	inhibition of the ROS production↓ ; Antiplatelet aggregation, reduce lipid
8	Katuki Picrorhiza kurroa	Katuki's choleretic and cholegogue actions can decrease the absorption of fats.

Table 5: Ayurvedic formulation in different heart diseases

Name of Ayurveda formulation	Ingredients	Indication
Pravakar Vati	*Lauha, abhra, shilajit,bansolochan*	*Hridroga*
Hrudayannva Rasa	*Parada, Gandhak , tamra , Arjuna*	*Kaphja hrudroga*
Shankara Vati	*Lauha, parada, gandhak, naga Bhasma*	*Kasa, swasa, hrudroga*
Nagarjunabhra	Abhra Bhasma , Arjuna	Hrudroga, Shoola
Chintamoni Rasa	*Lauha, parada, gandhak, , Swarna, abhra, shilajatu,*	*Kasa, swasa, hrudroga*
Yogendra Rasa		
Ratnakar Ras	*Lauha, parada, gandhak, hirak , Swarna, abhara, vaikranta, vanga*	Tridoshaja hritroga, krimija hrudroga
Arjuna Rista	Arjuna	*Hrudroga*
Arjun Ksherpaka	Arjuna	*Hrudroga*
Arjuna Tvak churna	Arjuna	*Hrudroga*
Visheswar Rasa	*Lauha, parada, gandhak, , Swarna, abhara, vaikrant, vanga*	*Kasa, swasa, hrudroga*
Trinetra Rasa	*parada, gandhak,abhra Bhasma*	*Hrudroga*
Panchanan Rasa	*parada, gandhak*	*Hrudroga*

B. Vihara **–** Reduction of cinta(stress), trasa(harassment), Soka etc is very important to reduce cortisol which reduce the risk of CVA accident and M.I. Mental stress can be managed through Pranayama(breathing exercise), dhyanya (Meditation), Asana(Yogic posture), Samyaka Vyayama(Regular and judicious exercise), Sadvritpalana, matra uchharana (chanting Omkara mantra). Cessation of smoking, and oral nicotine, optimisation of alcohol intake are also crucial for prevent and reduce the progression of CAD.[18] Savasana, Dhanurasana, Makarasana and Vajrasana are helpful in primary prevention of CAD. A recent study suggests that transcendental meditation may be extremely useful in secondary prevention of coronary heart disease and may reduce cardiovascular events by 48% over a 5-year period. Another small study suggests that yoga may be helpful in prevention of atrial fibrillation.[19] Brisk walking 20-60 minutes per day on 2 to 5 days per week for a period of 3 weeks to 12 months is the 1st steps for cardiovascular diseases prevention.[20]

C. Panchakarma Procedures **–** In CAD, constant imbalance of kapha dosha and medha dhatu leads to vitiation of Prana and Vyana vata. Panchakarma chikitsa (treatment by elimination) or detox therapy is an effective treatment modalities in Ayurveda which is based on elimination of vitiated doshas and accumulated toxins from the body through various interventions. Abhyanga, Urapichu, shira dhara can reduce blood pressure and stress.[21]

6. Advance Ayurveda Remedies Instable Angina with CAD

Stable angina pectoris is predictable or reproducible chest pain (or discomfort) caused by transient myocardial ischaemia that occurs when cardiac oxygen supply cannot meet demand of heart. People who experience angina symptoms often have little or no evidence of significant coronary artery narrowing. This phenomenon has given rise to the concept of ischaemia with no obstructive coronary artery disease (INOCA), a collection of conditions where blood flow to cardiac tissues is restricted in the absence of obvious epicardial blood flow obstruction, then it either be due to micro vascular changes in heart or vasospastic. But In CAD, most therapeutic approaches aim to control hypertension and hyperlipidaemia or modulate haemostasis in order to avoid thrombotic complications which can be approached by herbal medication.[21] Intensive life style modification, pranayama and Planned Ayurveda protocol can even reverse the CAD.[22-24] inflammation has been confirmed as a risk factor for CVDs, especially during atherosclerosis and coronary artery disease. High levels of high-sensitivity C-reactive protein (hs-CRP) and/or interleukin-6 (IL-6) are associated with higher absolute cardiovascular risk. In fact, Ayurveda remedies can have antioxidant, vasorelaxant, anti-inflammatory, anti-proliferative, or diuretic effects. Ayurveda remedies can also prevent VSMC phenotypic switching, inhibit endothelial dysfunction, platelet activation, lipid peroxidation, ROS production, and macrophage atherogenicity. Because of Ayurveda procedure and plants have wide range of molecular and cellular targets, herbal preparations can be used to treat and manage a range of CVDs.[25-26] Lasunadi Gugulu, Arjuna (Arjuna (Terminalia arjuna) preparation are best medicine for CAD.[27-30] Lasuna (garlic) has been postulated to have a beneficial effect on lowering blood pressure, reducing blood levels of cholesterol and triglycerides, and inhibiting platelet aggregation. Other cardiotonic Ayurveda medicinal plants and their mechanism of action described in **Table 4** The classical Ayurveda formulations narrated in Ayurveda are also illustrate (**Table 5**).

7. Conclusion

Modifiable and non-modifiable risk factors should identified to mitigate through Ayurveda interventions. Lasunadi Gugulu, Arjuna (Arjuna (Terminalia arjuna) preparation are best medicine for CAD with clinical evidences. alleviating angina, offering lipid-lowering effects, and providing anti-thrombotic benefits. These therapeutic approaches could complement to standard treatments, potentially enhancing symptom relief and improving overall survival outcomes of CAD. Ayurveda can also independently reverse coronary architecture of stable angina, completely eliminate the need for preventive modern medications in some cases. Arjuna (Arjuna (Terminalia arjuna) preparations are found best in CAD. So Ayurvedic strategies for the prevention and management of coronary artery disease (CAD) have transitioned from classical theoretical foundations to implementation in clinical settings, but more enthusiastic and dedicated Ayurveda scholars should come forward to create more evidences in the prevention and treatment of CAD.

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None.

9. Conflict of Interest

None.

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