Suggestions for next steps include the development of standard referral forms for use at the time of patients’ hospital discharge and improved communication among tertiary care, community care, and cardiac rehabilitation providers to facilitate access to cardiac rehabilitation programs.3

Yoga and cardiac rehabilitation

Cardiac rehabilitation has been shown to be beneficial in the recovery process after myocardial infarction. Among its component interventions, evidence suggests that exercise may have a stronger effect on mortality, while psychosocial interventions act more on quality of life measures. Although exercise-based cardiac rehabilitation has found to be extremely useful, there are limitations for developing countries like India, especially the cost and lack of manpower. Therefore, there is a need for an alternative simple and cost-effective technique. Yoga may be such an alternative technique.

Yoga practice leads to similar outcomes as cardiac rehabilitation (improved physical fitness, stress reduction, and lifestyle change). Yoga has contributed to the general well-being, decreased physiological arousal, better sleep, and appetite. Therefore, yoga could provide a useful framework to develop an economical cardiac rehabilitation program.4

Accordingly, a large Indo-UK study has been initiated to study the effectiveness of a yoga-based cardiac rehabilitation program (Yoga-CaRe), compared with the enhanced standard care group, in patients following acute myocardial infarction on cardiac morbidity, mortality and quality of life.5

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Yoga as a lifestyle polypill

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Abstract

Yoga is a holistic lifestyle and includes healthy diet (sattvic diet), physical exercise, stress management, and tobacco control, and, hence, it could be called as a lifestyle polypill. Yoga is becoming increasingly popular throughout the world because of its health benefit. Even the United Nations has realized its importance and has declared June 21 as the International Day of Yoga. Many studies suggest that the yoga lifestyle may be helpful in controlling risk factors for coronary heart disease life hypertension, type II diabetes mellitus, dyslipidemia, inflammation, oxidative and psychosocial stress, obesity, and smoking. A recent scientific statement of the American Heart Association has concluded that meditation could be considered as an alternative approach to lower blood pressure in all individuals with blood pressure levels more than 120/80 mmHg. Yoga has also been shown to be beneficial in the secondary prevention of coronary heart disease, cardiac rehabilitation, cardiac arrhythmias, and congestive heart failure. Yoga may even regress early and advanced athrosclerosis. However, there are several limitations of the reported studies, and methodologies are generally poor. Large multicenter, well-planned randomized trials are needed to confirm these findings. However, as yoga is a cost-effective, simple holistic lifestyle without any side effects, it could be recommended for primary and secondary prevention of cardiovascular disease and it can play a primary and complimentary role in this regard.

Key Words

• Meditation
• Risk factors
• Regression of athrosclerosis
• Cardiac prevention
• Yoga
• Lifestyle

Introduction

The word “Yoga” comes from a Sanskrit word “yuj,” meaning to join together. It connotes going from lower consciousness to the higher. Originating in India 5000 years earlier, today, the practice of yoga is becoming increasingly popular throughout the world.12 Even the United Nations has recognized its importance and declared June 21 as the “International Day of Yoga.”
**Yoga** is an integrated system of self-culture that aims at harmonious development of body and mind and covers all aspects of human life that lead to physical well-being, mental harmony, and happiness. Yoga envisages health in totality on the principle of a healthy mind in a healthy body. Yoga is a universal practical discipline irrespective of culture, nationality, caste, creed, sex, age, and physical conditions. Though there are several types of yoga described in ancient literature, hatha yoga is most commonly practiced. Core components of hatha yoga include stretching exercises and postures (asanas), breath control (pranayama), and concentration and thinking techniques (meditation) designed to promote physical, mental, emotional, social, and spiritual well-being. Yoga is a holistic lifestyle that includes all components of healthy lifestyle such as low-fat, vegetarian diet (satvik diet); physical exercises; tobacco avoidance; and stress control, and, hence, may be described as a "lifestyle polypill." 

### Beneficial effects of yoga lifestyle

Beneficial effects of yoga have been reported in multiple chronic conditions including depression, stress, anxiety, menopausal symptoms, arthritis, low back pain, cancer, allergies, asthma, acid peptic disease, irritable bowel syndrome, migraine, metabolic syndrome, diabetes mellitus (DM), cardiovascular disease (CVD), etc. Yoga appears to be especially beneficial in CVD prevention.

### Yoga for control of risk factors

#### Hypertension

Numerous studies have been conducted to assess the role of yoga in the management of hypertension. In earlier uncontrolled studies, the use of shavasana (corpse posture, a type of yoga activity for relaxation) and transcendental meditation (TM) were reported to lower both systolic and diastolic blood pressure significantly.12,13 In a randomized trial, yoga was found to be equally effective as an antihypertensive therapy over a 11-week period.14 Another randomized controlled trial demonstrated that yoga and biofeedback were capable of producing long-term beneficial effects in the treatment of hypertension.15 A meta-analysis involving nine well-controlled randomized trials showed that, compared with control, TM was associated with a modest decrease of systolic blood pressure of 4.7 mmHg and diastolic blood pressure of 3.2 mmHg.16 Recently, several controlled studies and meta-analysis have reported about the immediate and long-term effects of yoga practices in pre-hypertension and mildly hypertensives.17,18 Although the results are mixed, majority of the trials show a modest decrease in blood pressure. However, most of these studies have low methodological quality, and, hence, large randomized well-controlled studies are needed for defining the role of yoga in hypertension. A scientific statement of the American Heart Association has recently concluded that TM and biofeedback approaches show a modest effect in reducing blood pressure (Class IB, Level of Evidence B), and, hence, has suggested that it is reasonable for all individuals with blood pressure levels >120/80 mmHg to consider alternative approaches like TM as adjunct methods to lower blood pressure when clinically appropriate.19

#### Lipid profile

Several randomized controlled trials have demonstrated significant improvement in lipid profiles by practicing yoga for 6 weeks to 2 years in healthy subjects and in patients with hypertension, DM, and coronary heart disease.20 A recent randomized trial has demonstrated a significant decrease in total cholesterol, triglycerides, and low-density lipoproteins cholesterol (LDL-C), and improvement in high-density lipoproteins (HDL) cholesterol in diabetic patients with dyslipidemia.21 A meta-analysis of 30 randomized control trials in 751 subjects demonstrated that LDL-C decreased by 12 mg/dL as compared with controls.22 However, many studies have utilized diet control, health education, and other therapies in addition to yoga. Hence, results have to be interpreted cautiously. It may be concluded that yoga may complement diet to lower lipids, and thereby further decrease the risk of CVD.

#### Tobacco

A few randomized and non-randomized studies suggest that different types of yoga intervention alone or with behavior therapy may be able to enhance quitting smoking rates.23,24 A recent randomized controlled trial suggested that a brief training of mindfulness meditation reduced smoking by 60% and also curbed craving in smokers. These changes were probably related to improved self-control, as demonstrated by increased activity in the anterior cingulated and pre-frontal cortex in functional MRI.25 Two meta-analysis have also suggested that yoga intervention holds promise as an efficacious complimentary therapy for smoking cessation.26 However, the follow up has been short ranging from 8 weeks to 6 months.

#### Inflammation, oxidative stress, and procoagulant status

Two small uncontrolled trials have suggested that yoga practices for 12–16 weeks result in a significant decline in fibrinogen and increase in fibrinolytic activity.27 A few other small studies suggest that yoga may reduce oxidative stress in both healthy population and chronic insulin resistance-related disorders.28–32 Sarvottam et al. demonstrated that after 10 days of yoga intervention in 51 obese individuals, a significant reduction in plasma IL-6 and an increase in plasma adiponectin was observed, suggesting that even short-term yoga-based program may reduce the risk of CVD, as indicated by a decrease in inflammatory markers.23 However, this is a non-randomized study, and diet and exercises have also been used.

#### Psychosocial stress

Psychosocial stress is a significant risk factor for hypertension, stroke, myocardial infarction, insulin resistance, and cardiovascular mortality.33 Recently, the American Heart Association has suggested that depression should be considered as a major risk factor similarly to smoking, hypertension, diabetes, and obesity.34 There is experimental evidence to suggest that yoga can lead to improvement in cardiovascular response to stress and cardiovascular recovery from stress.35 Several studies also suggest that stress can be reduced significantly with regular practice of yoga and meditation.36,37 One study suggests that yoga may be as useful as drugs to control depression.38

#### Obesity

Several randomized controlled trials have demonstrated an improvement in body weight and/or composition by yoga-based programs relative to control.39–41 These studies have been performed in healthy individuals and those with hypertension and other CVD risk factors, type II DM, and coronary heart disease. Yoga was associated with a 1.5 to 13.5% decrease in body weight. Central obesity in metabolic syndrome has also been shown to be decreased by regular practice of yoga.42 Regression of atherosclerosis

Both early and advanced atherosclerosis has been shown to be significantly reduced by regular practice of yoga for up to 1 year. Fields et al. utilizing TM and Manchanda et al., utilizing yoga practices, have demonstrated that 9–12 months practice of yoga/meditation significantly reduced carotid intima-media thickness in patients with hypertension and metabolic syndrome.43,44 Four small controlled studies utilizing coronary angiography in advanced coronary heart disease showed that regular practice of yoga for 1–5 years along with the use of low-fat vegetarian diet cause retardation or regression of coronary stenosis as compared with the usual care group.45–48 In addition, the lipid profiles, body weight, mental stress, myocardial ischemia, and need for interventional procedures were also significantly reduced as compared with controls.

### Cardiac rehabilitation

Yoga practices have been shown to contribute to the general well-being, decreased physiological arousal, better sleep, better appetite, and decreased psychosocial stress.49–51 Therefore, yoga could provide a useful framework to develop an economical cardiac rehabilitation program. In a small randomized control trial, Tulippe et al. reported that yoga-based cardiac rehabilitation in 102 post-MI patients was associated with decreased mortality and more patients resuming work within 6 months.52 Recently, a study utilizing yoga-based cardiac rehabilitation after coronary artery bypass surgery demonstrated a significant decrease in perceived stress, anxiety, depression, and negative effects.53 The left ventricular ejection fraction was also reported to be improved with reduction in blood glucose and decrease in LDL and increase in HDL. Silberman et al., in a yoga-based intensive cardiac rehabilitation program in 2,974 individuals from 24 diverse sites, also concluded that yoga-based cardiac rehabilitation program was feasible and sustainable for most patients and was associated with numerous subjective and objective improvements in health outcomes.54 Recently, a randomized control trial of TM has reported that there was a 48% risk reduction in primary end points (composite of all-cause mortality, myocardial infarction, and stroke) over a period of 5.5 years.55

### Arrhythmias and heart failure

A few studies have demonstrated that yoga may be useful in control of premature ventricular ectopics and may also decrease the atrial fibrillation burden in patients with paroxysmal atrial fibrillation.56 Yoga has also been reported to be useful in heart failure patients by improving peak oxygen consumption, quality of life, and

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### Notes

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  - DM and metabolic syndrome
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**Possible mechanism**

Although the exact mechanisms underlying the potential beneficial effect of yoga on CV system are not fully understood, several postulations have been put forth. Streeter et al. have recently proposed a theory to explain the benefits of yoga in diverse, frequently comorbid medical conditions based on the concept that yoga reduces allostatic load in stress response systems so that optimal homeostasis is restored. They hypothesized that stress produces an:

- **Impulse of the autonomic nervous system with decreased parasympathetic and increased sympathetic activity**
- **Under activity of the gamma amino butyric acid (GABA) system, the primary inhibitory neurotransmitter system**
- **Increased allostatic load**

They further postulated that yoga-based practices correct under-activity of the parasympathetic nervous system and GABA systems, in part, through stimulation of under-activity of the parasympathetic nervous system, and reduce the allostatic load. Innes et al., in an exhaustive review, had earlier postulated two interconnected pathways by which yoga reduces the risk of CV events following the mechanisms of parasympathetic activation coupled with decreased reactivity of sympathoadrenal system and hypothalamic-pituitary-adrenal (HPA) axis (Figure 1). Their review of numerous studies suggested that yoga promotes a reduction of sympathetic activation, hypothalamic-pituitary-adrenal (HPA) axis (Figure 1). Their review of numerous studies suggested that yoga promotes a reduction of sympathetic activation, and reduces the risk of CV events through the mechanisms of parasympathetic activation coupled with decreased reactivity of sympathoadrenal system and hypothalamic-pituitary-adrenal (HPA) axis (Figure 1).

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**Figure 1:** Psychophysiology of yoga in heart disease: possible mechanisms (modified from Innes et al., 2005)

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**Limitations of yoga studies**

Although several published studies have demonstrated that yoga is useful in primary and secondary prevention of CV disease, many limits with respect to the reported studies. Most of the studies are single-center, have small sample size, have non-uniform methodologies, and only a limited number of RCTs have evaluated the impact of yoga on CVD. Majority of studies have short follow up and outcome studies are lacking. Multicentric large studies using uniform methodologies with long-term outcomes are needed. However, even with the present evidence and considering that yoga is a simple cost-effective intervention, there are several limitations of the reported studies and methodologies that are generally poor. Large multicenter well-planned randomized trials are needed to confirm these findings. However, as yoga is a cost-effective, simple holistic lifestyle without any side effects, it could be recommended for primary and secondary prevention of CVD and it can play a primary and complementary role in this regard.

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**References**

Pathway 1
Cardiovascular changes
• Endothelial function
• Oxidative stress
• Heart rate variability

Pathway 2
Neuronal changes
• GABA systems
• Under-activity of the parasympathetic nervous system
• Increased allostatic load

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Conclusion

Yoga is a holistic lifestyle consisting of healthy diet, exercise, stress management, and tobacco control, and, hence, could be termed as a lifestyle polypill. Many studies suggest that the yoga lifestyle may be helpful in controlling risk factors for coronary heart disease like hypertension and DM, dyslipidemia, inflammation, oxidative and psychosocial stress, obesity, and smoking. Yoga has also been shown to be beneficial in the secondary prevention of coronary heart disease, rehabilitation, cardiac arrhythmias, and congestive heart failure. Yoga may even regress early and advanced atherosclerosis. However, there are several limitations of the reported studies and methodologies are generally poor. Large multicenter well-planned randomized trials are needed to confirm these findings. However, as yoga is a cost-effective, simple holistic lifestyle without any side effects, it could be recommended for primary and secondary prevention of CVD and it can play a primary and complementary role in this regard.

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