Healing the Heart: Can Yoga be the Missing Piece that Completes the Puzzle in Modern Medicine?

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Abstract

Over the years, research has revealed that yoga is beneficial in stress reduction, weight loss, and increased fitness. Yoga has also been found to be valuable in the treatment and prevention of numerous medical conditions including diabetes, obesity, depression and cardiovascular disease. In fact, yoga fosters a lifestyle that promotes better heart function, through a holistic health approach developing the mind-body relationship. Recently, studies have confirmed that the regular practice of yoga has been beneficial in the treatment and prevention of cardiovascular disease and conditions such as hypertension, coronary artery disease, and arrhythmias. In light of these findings, yoga has gained popularity in the medical field, including with physicians that specialize in the fields of cardiology and neurology. Improving our understanding of the interactions between the brain and the cardiovascular system has paved a way in unlocking the connection of mind body control. This article summarizes the current role of yoga in treating cardiovascular conditions.

Keywords: Weight loss; Hypertension; Coronary artery disease

Introduction

Cardiovascular Diseases (CVD) remain one of the leading causes of mortality across the world[1]. Recent data suggest that unfavorable lifestyle trends promoting weight gain are leading to an increase in CVD risk factors such as diabetes mellitus, hypertension, hypercholesterolemia, obesity, mental stress, and metabolic syndrome[1].

It has been shown that regular practice of yoga can have a significant positive effect on general as well as cardiovascular health of individuals. Numerous studies have established the health benefit of yoga, primarily on hypertension, hypercholesterolemia and obesity which are the leading risk factors associated with cardiovascular diseases[2-6]. Practice of the different arms of yoga: asana, pranayama and meditation, alone or in combination, have been shown to boost immunity and decrease stress, reduce obesity and hence have benefitted patients with CVD[2]. Yoga has been described in ancient Indian texts to balance sympathetic and parasympathetic nervous system imbalances which have been proven to maintain optimal health[7].

The autonomic nervous system (ANS or visceral nervous system) is the part of the peripheral nervous system that acts as a regulatory enterprise functioning largely below the level of consciousness, and controls visceral functions. The ANS affects heart rate, blood pressure (amongst other heart related parameters), digestion, respiration rate, salivation, perspiration, adjustment of vision, micturition, and sexual arousal. It has been recognized for upward of 50 years in the field of medicine with studies demonstrating that the alteration of autonomic nervous systems could not only alter heart rate and blood pressure but also affect individual muscle cells of the heart[8,9].

Systemic Inflammation & Autonomic Imbalances in Cardiovascular Disease

Chronic systemic inflammation has been linked to increased incidence of cardiovascular disease as well as an increased incidence of arrhythmias as evidenced by increased prevalence of both in subjects with chronic elevation of the inflammatory markers. Elevated levels of inflammatory markers like IL-6, IL-8, and CRP as seen in patients with chronic inflammatory states have been associated with increased and accelerated atherosclerosis and increased CVD mortality[10,11].

They have also been associated with endothelial dysfunction, increased cholesterol levels and high sympathetic tone. Arrhythmias like atrial fibrillation are also associated with increased levels of these inflammatory markers and low heart rate variability. Recent data shows that regular practice of yoga can considerably decrease the levels of these markers and has decreased the incidence of atrial fibrillation.

ANS anatomically and physiologically is divided into the sympathetic nervous system (SNS) and the parasympathetic nervous system (PSN). The levels of activity are generally inversely related; for example, if the SNS is over active, the PNS is usually suppressed. The ANS exerts its effects by the use of chemical molecules, also called neurotransmitting hormones, releasing these hormones directly in the bloodstream. The effects of the ANS are critical as they provide for defensive mechanisms in all living species such as the fight or flight response that is mediated by activation of the sympathetic nervous system.

The fight or flight response is an old ancestral human response to survival. The body handles this response in part by the release of stress hormones (adrenaline and cortisol) and is responsible for a series of changes in the body i.e. raising blood pressure, heart rate, and blood sugar levels. These changes help a person deal with a crisis situation. Over years, research has shown that various manifestations of heart disease, such as, heart failure, disturbance of the heart rhythm (arrhythmias), blood pressure variations, and symptoms like syncope, all to a certain degree have an imbalance between the sympathetic and parasympathetic nervous system. This same response is also activated in

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patients with heart failure and after a heart attack. The PNS, as opposed to SNS, tends to slow the heart and lower blood pressure, allowing recovery after a stressful event. Blood flow that was diverted away from the non-essential organs (intestines and reproductive organs) returns. This is more of a restorative phase and may be termed as ‘rest and digest’.

Recent evidence suggests that both sympathetic and parasympathetic neural input to the heart influence a number of parameters affecting the electrical system and the blood supply of the heart, which in turn affects the rhythm, rate and the pump function of the heart[12]. Many yoga practices, including asana, slow breathing (pranayama) and meditation, increase activation of the PNS and lead to mental relaxation. However, yoga techniques are more than just relaxation. One of yoga’s secrets, documented in research from the Swami Vivekananda Yoga Research Foundation near Bangalore, India, is that more active practices followed by relaxing ones lead to deeper relaxation than relaxing practices alone. There is overwhelming evidence, especially from recent work on the impact of the autonomic nervous system on the heart, which supports the fact that yoga has an enormous impact on the autonomic modulation to the heart [13]. The regular practice of yoga, especially when all three components of asana, pranayama and meditation are included, has a positive effect on heart health.

**Impact of Yoga on HRV and Autonomic Plasticity**

Heart tissue is a dynamic substrate continuously changing its electrophysiological and mechanical properties in response to autonomic nervous system modulation. Various yoga techniques either alone or in combination have shown overtime and in various studies to have a beneficial effect on balancing the autonomic functions which have been implicated in the various manifestations of cardiac diseases.

The role of the autonomic nervous system (ANS) in the pathogenesis of heart rhythm disturbances, particularly atrial fibrillation was first recognized by scientists in 1978. It has been seen in numerous studies that heart rhythm disturbances can be either sympathetically or parasympathetically (vagally) mediated. Various yoga techniques have shown to have an impact on the autonomic modulation and thus play an important role in symptomatic relief in patients with various heart rhythm disturbances like atrial fibrillation as well as in patients with various devices implanted for prevention of certain arrhythmias e.g. ICDs[8,14,15].

**Anti-inflammatory Effects of Yoga**

Emotional and physical stressors activate immune and endocrine pathways that can enhance proinflammatory cytokine production. There are numerous studies to demonstrate that the regular practice of yoga with all three components - asana, pranayama and meditation - minimize autonomic and inflammatory responses when an individual is placed in stressful situations[16].

**Yoga and Stress Reduction**

It is known that when under stress, there is an increase in the secretion of stress hormones, like cortisol and the adrenal hormones. Increased cortisol levels have been associated with obesity and development of diabetes, uncontrolled hypertension and acceleration of atherosclerosis. Studies have shown significant decrease in cortisol and other stress hormones (up to 40%) in patients who regularly performed...
yoga for at least 8 weeks. The practice of yoga is well-demonstrated to reduce the physical effects of stress on the body, and found to lower cortisol levels[17]. Both hypertension and diabetes are significant risk factors for the development of heart disease (atherosclerosis and arrhythmias). Studies have shown that the above mentioned stress hormones play a major role in the control of hypertension and diabetes and it has been shown in numerous studies that regular practice of yoga significantly benefits in control of both HTN and DM[18].

Specific Benefits of Yoga in the CVDRealm

Hypertension and yoga

There are three major factors that increase the risk of developing cardiovascular disease: hypertension or high blood pressure, insulin resistance (a precursor to diabetes), and cholesterol levels[7]. With modernization and lack of physical activity, the prevalence of these risk factors for heart disease is on the rise. Hypertension is a risk factor for heart disease; significant research has been conducted to discover methods for the treatment and prevention of hypertension.

In a recent study, Iyengar yoga examined the effect of yoga when practiced by prehypertensive patients (those in the beginning stages) showed a reduction in blood pressure from pre-yoga to post-yoga period[19]. Even small decreases in blood pressure are important because they significantly lower the risk of death caused by heart disease and stroke. A separate study revealed that yoga was also effective in reducing blood pressure in patients with moderate forms of hypertension. The dose of blood pressure medications was reduced or eliminated all together in part due to yoga. The regular practice of yoga helped maintain optimal blood pressure in these patients[20].

Arrhythmia and yoga

Numerous studies have shown the benefits of yoga on hypertension and coronary artery disease. However, only recently have the benefits of yoga in people with arrhythmia burden, or more commonly known as an irregular heartbeat, been studied. The regular practice of yoga, including asanas (yoga poses), pranayama (breathing exercises) and meditation, has been found to have a beneficial effect on the body's electrical system helping to restore an irregular rhythm to regular rhythm in a high percentage of patients[25]. A study conducted at the University of Kansas Medical Center has shown the role of yoga in treatment of atrial fibrillation.

Figure 2: Mechanistic possibilities of how Yoga can help cardiac arrhythmias.
Atrial fibrillation is an abnormal heart rhythm involving the atria (the top two chambers of the heart). Atrial fibrillation causes the upper half of the heart to quiver and not beat properly. While atrial fibrillation is usually not life threatening by itself, living with the arrhythmia burden can be a challenge. It can contribute to the risk of other common complications with arrhythmia, such as stroke, decrease in heart function, and reduction of exercise tolerance. It is often necessary for these patients to be on multiple medications such as blood thinners and medications to control heart rates. A recent study showed that the practice of yoga reduced the number of episodes of atrial fibrillation by 50%. It also showed a reduction in anxiety and depression scores and an overall improvement in quality of life in patients [26]. This is beneficial in public health, as many treatments of atrial fibrillation include medications with unwanted side effects or invasive procedures. Instead, the routine practice of yoga appears to be more advantageous, non-invasive, and cost effective. Another sign of a healthy heart is heart rate variability, where the time interval between heart beats varies; heart rate variability has been shown to be higher in yoga practitioners than in non-practitioners [27]. Figure 2 shows the possible mechanisms through which yoga can influence CNS and ANS in arrhythmia control.

**Yoga and heart failure**

Heart failure (HF) affects approximately 5.7 million individuals in the United States every year. It is also a leading cause of hospital admissions and repeat admissions. Symptoms of HF include shortness of breath, fatigue, and an overall reduction in physical functions. Many people with HF experience a diminished quality of life. Although medications have improved both symptoms and decreased mortality, side effects and substantial risks plague the consistent use of these medications [28-30]. In a study of an 8-week program of yoga comprising the three components of *asanas*, *pranayamas* and meditation for patients with HF, the major findings were:

1. A modified yoga program was shown to be safe in chronic HF patients that were considered stable.
2. HF patients who participate in a modified yoga program can improve their physical function (e.g., strength, balance, and endurance).
3. HF patients who participated in a modified yoga program had a significant improvement in their quality of life.

Yoga therapy offered additional benefits to the standard medical care of predominantly HF patients by improving cardiovascular endurance, quality of life and flexibility.

**The “Yoga My Heart” study**

The 'YOGA My Heart' Study [26] was a prospective study conducted at the University of Kansas Medical Center and was spearheaded by our group. The context under which the study was conducted was that yoga reduces stress, stabilizes the autonomic nervous system and benefits cardiovascular health and that yoga in reduces arrhythmia burden. The study was conducted to examine the impact of yoga on the AF burden, quality of life (QoL) and depression and anxiety as there was no existing data to show this.

AF frequently affects the quality of life (QoL) and imposes a significant psychosocial burden both on the individual as well as the society in addition to the significant morbidity and mortality burden (more heart failures, hospitalizations, increased incidence of strokes and heart attacks). AF patients have much worse QoL compared to the general population, even more than patients with coronary artery disease and congestive heart failure.

In this study, patients with paroxysmal AF between 18-80 years of age were screened. After appropriate screening, 52 patients were enrolled in the study. The enrollment duration was 27 months. Iyengar yoga was used as an interventional therapy in this study. All training sessions were conducted in groups of 20-25 people in a yoga studio by a certified professional yoga instructor. These sessions lasted for approximately 60 minutes two times a week over a period of three months. During each yoga session, 10 minutes of pranayamas, 10 minutes of warm-up exercises, 30 minutes of asanas, and 10 minutes of relaxation exercises were performed. The patients were encouraged to perform all exercises as accurately as possible.

The *pranayamas* used in the study were:

- Ujjayi pranayama
- Dirgha pranayama and
- Nadishodhanaprayanama

The *asanas* included:

- sukasana
- bitilansana
- adhomukhavisranya
- danasana
- janusirsana
- paschimottanasana
- tadasana
- uttanasana
- setubandhasarvangasana
- sputapadangusthasana
- pavamuktasana and
- savasana

Each asana lasted 30-60 seconds and some of them were repeated multiple times during a session. Patients relaxed at the end of each yoga session, with 10 minutes of savasana followed by meditation practiced for relaxation.

All patients were provided with log sheets to record the symptoms of AF during the period. Patients' symptoms and cardiac rhythms were also monitored using cardiac event monitors and the data was statistically analyzed at the end of the study. Statistical analysis of the data showed that although practicing yoga does not cure AF, it significantly improves symptoms, arrhythmia burden, anxiety & depression scores, physical functioning, general health, vitality and social functioning in patients suffering from AF. Yoga resulted in up to 50% reduction of symptomatic AF episodes. Yoga is an effective complementary and alternative therapy in the management of patients with AF.

**Conclusion**

Yoga can be tailored to each individual, increasing both fitness and energy levels of those participating in it. This individualized characteristic of yoga is valuable to many, but especially to people with cardiovascular disease who may be weaker and more easily fatigued than...
heart healthy individuals. Current studies at the University of Kansas Medical Center are investigating the effects of yoga in patients with arrhythmias, including neurocardiogenic syncope (sudden and brief loss of consciousness) and inappropriate sinus tachycardia (sensation of heart racing at times). Yoga may complement more invasive procedures and current treatments/medications. It may also help in the future to help elucidate the mechanism from which these conditions manifest.

Based on current studies, yoga is beneficial both as a treatment (to an extent in conjunction with medical measures) and as a preventative measure against cardiovascular disease. Along with these benefits, yoga is cost-effective, straightforward to learn, and has minimal side effects. We are just beginning to uncover the true benefits that yoga has on cardiovascular disease. Additional research will help us understand and unlock the vast number of potential benefits that yoga can provide in maintaining a healthy heart.

References