Inflammaging and cardiovascular disease: Management by medicinal plants

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Abstract

Background: In aging, a host of molecular and cellular changes occur which accelerate alteration and progression of inflammatory diseases. These conditions in the elderly people cause appearance of a phenomenon which has been denoted as "inflammaging". Understanding the pathogenesis and finding new methods for management of inflammaging are essential.

Purpose: In this paper we tried not only to explain inflammaging and its treatments with concentrating on medical plants but to collect a sufficient collection of anti-inflammatory plants with focusing on their mechanism of action.

Method: In this review paper, by searching in indexing cites, desired articles were obtained since 1995 by using keywords of inflammation, inflammaging, inflammation pathophysiology, free radicals and inflammation, aging inflammation, inflammatory disease, and plants or herbal medicine in inflammation.

Sections: In advanced age the generation of free radicals increases in cardiovascular system. Pathological inflammation is also associated with production of excess free radicals. More importantly, chronic inflammation makes aged people susceptible to age-related diseases. Some medicinal plants have been shown promising results in inhibition of inflammaging. Some other sections such as inflammation and inflammaging in cardiovascular diseases, oxidative stress in cardiovascular complications, prevention and treatment strategies are presented.

Conclusion: The results of published papers show that the symptoms of several inflammatory diseases can be inhibited or treated by active ingredients from medicinal plants.

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Introduction

The world's population age is increasing and the aging population is a risk factor for cardiovascular diseases (CVD). Aging generally causes some changes which, even in absence of usual risk factors, render the cardiovascular system prone to some diseases (Lakatta 2000).

The progressive degeneration of the heart in elderly makes it more vulnerable to stress and causes an increase in cardiovascular morbidity and mortality (Brodsky et al. 2004). Cardiovascular diseases are also fuelled by some other risk factors such as diabetes (Baradaran et al. 2013; Behradmanesh et al. 2013), hypertension (Asgary et al. 2013; Ghorbani et al. 2013), and obesity (Nasri and Rafieian-Kopaei 2013; Rabiei et al. 2013a; Favarato et al. 2014). Aging is a phenomenon resulted from genetic, epigenetic stochastic, and environmental events in different cells and tissues. In fact in aging, a host of molecular and cellular changes occur which accelerate these alterations and implicate in the progression of arterial diseases (Rabiei et al. 2013b; Favarato et al. 2014). Pathological inflammation is also associated with production of excess free radicals arising predominantly from mitochondria (Beller 2010; Rafieian-Kopaei et al. 2012). There are also evidences showing that in advanced age the generation of free radicals increase in cardiovascular system (Judge et al. 2005; Asadbeigi et al. 2014). More importantly, chronic inflammation makes aged people susceptible to age-related diseases (Franceschi et al. 2000).

A wide variety of diseases including diabetes (Asadbeigi et al. 2014) cancer (Azadmehr et al. 2011; Nasri and Rafieian-Kopaei 2014), infection (Bagheri 2013; Bagheri 2013), atherosclerosis (Rafieian-Kopaei et al. 2011; Rafieian-Kopaei et al. 2014a), cardiovascular diseases (Khosravi-Boroujeni et al. 2013; Sarrafzadegan et al. 2013), Alzheimer (Rabiei et al. 2013c, 2014) and other degenerative diseases...
Inflammation and cardiovascular disease

Inflammation participates to the pathophysiology of a wide variety of chronic diseases particularly injury and infectious diseases. Interaction of various cells in the adaptive and innate immune systems with inflammatory mediators modulates the acute and chronic inflammation causing various diseases. This coordination in inflammatory mechanisms triggers remodeling of the extracellular matrix, oxidative stress, tissue injury, angiogenesis and fibrosis in various tissues. These inflammatory mechanisms are involved in most of cardiovascular complications, including coronary artery disease, ischemia, rheumatic disease, rheumatoid arthritis, plaque disruption, thrombosis and atherosclerosis. The mastery of the inflammatory responses necessitates the development of new approaches to the prevention and treatment of chronic diseases associated with aging, such as atherosclerosis (Libby, 2007).

Although inflammation was previously considered as being a response to development of atheromatous vascular damage, it is now considered as the main causing factor in atherosclerosis rather than being its result. In this regard, a dramatically increased risk of cardiovascular disease has been reported in patients with pre-existing inflammatory diseases. Also, patients with autoimmune disorders including lupus erythematosus and rheumatoid arthritis have higher rates of cardiovascular diseases such as atherosclerosis (Franceschi et al. 2000). Untreated infections such as periodontal disease which cause inflammation are associated with increased risk of cardiovascular complications (Candore et al. 2010).

The inflammation mediators have been shown to participate in atheromatous changes and vascular insults. Secretion of a host of inflammatory factors might contribute to the increased cardiovascular risks. The cardio-protective effects of many of drugs are mediated through improvement of systemic inflammation. The targeted suppression of various pro-inflammatory cascades in adipocytes specifically represents an exciting new therapeutic opportunity for the cardiovascular disease area (Berg and Scherer 2005).

The mechanisms underlying cardiovascular complications by systemic inflammation are not established. Type 2 diabetes mellitus, hypercholesterolemia, atherosclerosis, hypercoagulability, and metabolic syndrome are associated with coronary vasculopathy, and with circulating serum factors which mediate the connections between these disease conditions. These circulating mediators are mostly participated in systemic inflammation. Therefore, these factors may show the evidence for their connections with cardiovascular pathology (Berg and Scherer 2005; Rafieian-Kopaei 2014).

Oxidative stress in cardiovascular complications

Reactive oxygen species induced oxidative stress play a crucial role in development of vasculopathies, such as hypertension, atherosclerosis and restenosis after angioplasty. Although atherosclerosis was initially suggested to be the result of an injury to endothelial cells and subsequent macrophage infiltration, however, LDL oxidation and its implication in formation of fatty streaks are very important in process of atherogenesis (Griendling and FitzGerald 2003).

Various free radicals are produced in cardiovascular system and play a crucial role in vascular physiology as well as pathophysiology;
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