

Mini Review

Thyroid dysfunction and the heart

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ABSTRACT

Thyroid hormones, in addition to its metabolic and thermoregulatory functions, regulates cardiac performance. Untreated overt thyroid dysfunction is a cause for heart failure while subclinical thyroid dysfunction increases risk for heart failure among subjects with and without underlying heart disease. Thyroid dysfunction is considered to be a modifiable risk factor for patients who are at risk for heart failure.

Key words: Heart failure, hyperthyroidism, hypothyroidism

INTRODUCTION

Thyroid hormones are required for a variety of metabolic and developmental processes. Heart is one of the target organs for thyroid hormone action. Overt thyroid dysfunction is associated with increased cardiac morbidity. Therefore, thyroid dysfunction is considered to be a modifiable risk factor for those who are at increased risk of cardiovascular disease.^[1]

Thyroid hormone influences cardiac performance by genomic and non genomic effects.^[2-6] It regulates cardiac output by affecting stroke volume and heart rate. Several cardiac proteins are transcriptionally regulated by T3. It also regulates transcription of pacemaker related genes and angiotensin receptors in vascular smooth muscle cells. The non genomic effects include transport of ions (calcium, sodium and potassium) across plasma membrane, glucose and amino acid transport, mitochondrial function and a variety of intracellular signaling pathways. Thyroid hormones have a proangiogenic effect in adult heart and this occurs via both non genomic and genomic effect.

HYPERTHYROIDISM

T3 promotes relaxation of the peripheral vasculature, decrease systemic vascular resistance by its actions of vascular smooth muscle cells and endothelial nitric oxide

production. There is reduction in renal perfusion pressure and activation of the rennin angiotensin aldosterone system which leads to increase in sodium absorption and blood volume. The cardiac preload (left ventricular end diastolic volume) is increased. There is increase in heart rate. This increase in heart rate, high cardiac output and decreased peripheral vascular resistance leads to a hyper dynamic circulation. Long term exposure to thyroid hormone excess may lead to increased left ventricular mass, arterial stiffness, left atrial size, diastolic dysfunction and impairment of left ventricular function. These changes are reversible as there is no cardiac fibrosis.

Heart failure is the main complication of all forms of heart disease. The American College of Cardiology has defined it as a complex syndrome that impairs the ability of the ventricle to fill with or reject blood. Patients with hyperthyroidism are at increased risk for atrial arrhythmias and heart failure specially in elderly patients. Patients with severe hyperthyroidism may develop high output heart failure. The clinical manifestation and severity vary depending on the age of patients, duration and severity of hyper thyroidism and presence of underlying heart disease. Patients on amiodarone induced thyrotoxicosis are at increased risk for adverse cardiac events. Association of subclinical hyperthyroidism and cardiovascular disease is not very clear.

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Hypothyroidism is associated with low cardiac output due to decreased heart rate and stroke volume. Vascular function may also be deranged in hypothyroidism. There is increased cardiovascular disease risk related to coronary artery disease, cardiomyopathy and lipid disorders.^[7] Some studies have suggested increased risk for cardiac death in patients with subclinical hypothyroidism. However, there is difference of opinion regarding whether the increased risk is related to the subclinical hypothyroidism or associated lipid abnormalities, metabolic syndrome etc. There is no definite evidence to document benefit of thyroxin substitution in these patients.

Heart failure is one of the major causes for mortality in developed countries. It is the final common path for most cardiac diseases. Thyroid dysfunction is considered to be one of the modifiable risk factors for heart failure. Therefore, screening for thyroid dysfunction is recommended for all patients with newly diagnosed heart failure.

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