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Thyroid dysfunction and atrial fibrillation: The role of myocardial hypothyroidism

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Both hyperthyroidism and hypothyroidism can lead to heart failure (HF) development. HF is associated with an increased risk of atrial fibrillation (AF). While it is well established that hyperthyroidism increases AF incidence, the effect of hypothyroidism on AF is not so well recognized. To investigate the effect of altered thyroid status on AF inducibility, we treated thyroidectomized rats with placebo, 3.3mg L-thyroxine (T4), or 20 mg T4 pellets (60 day release form) for 2 months. At the end of treatment, hypothyroid, euthyroid, and hyperthyroid status was confirmed in the respective groups. Although hypothyroidism and hyperthyroidism had different effects on heart rate and cardiac function, both increased significantly AF susceptibility. AF inducibility was 78% in hypothyroid, 67% in hyperthyroid, compared with 11% in the euthyroid group (both $p<0.05$). In light of the evidence suggesting the presence of myocardial tissue hypothyroidism in HF, we hypothesized that not only may myocardial tissue hypothyroidism contribute to HF development, but may also increase AF incidence. Hence, we have studied the effect of thyroid hormone (TH) replacement therapy on AF arrhythmogenesis in a rat myocardial infarction (MI) induced HF model. Rats with large MIs (>40%) were randomized into T4 (n=14) and placebo (n=15) groups 2 weeks after MI and treated for 2 months. Compared with the placebo, T4 treatment attenuated atrial effective refractory period prolongation and reduced AF inducibility (AF/atrial flutter /tachycardia was inducible in 11/15 rats, or 73% in placebo vs 4/14 rats, or 29% in the T4 treated group, $P<0.05$). It is concluded that hypothyroidism, similar to hyperthyroidism, can lead to increased AF vulnerability in rats. Moreover, correcting myocardial tissue hypothyroidism with TH replacement therapy in HF may attenuate atrial remodeling and reduce AF inducibility post MI-HF. Clinical studies are still needed to confirm such benefits in patients.

Biography

Youhua Zhang was MD (1990), in Xinjiang Medical College, Urumqi, China. He completed his PhD (1993), Peking Union Medical College and Chinese Academy of Medical Sciences, Beijing, China. He is the Resident to Attending Physician in Cardiology, Cardiovascular Institute and Fu Wai Hospital, Chinese Academy of Medical Sciences, Beijing, China (1990-1999). Also Postdoctoral Fellow to Project Staff/ Research Assistant Professor, Cleveland Clinic, Cleveland, OH (1999-2011). His current position: Assistant Professor, NYIT College of Osteopathic Medicine, Old Westbury, NY, 2011-present.Publications: ~70 peer reviewed journal articles. Zhang has broad interest in cardiac electrophysiology, arrhythmias and heart failure research. He has pioneered the use of selective atrioventricular node vagal stimulation to control ventricular rate during atrial fibrillation and the use of vagus nerve stimulation to treat heart failure. Dr. Zhang is also an expert in studying atrioventricular (AV) node electrophysiology. He discovered a novel index for dual pathway AV node electrophysiology, termed His electrogram alternans- also called Zhang's phenomenon. This new index permits monitoring dual pathway conduction on a beat by beat basis.

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