Testosterone deficiency syndrome and cardiovascular health: An assessment of beliefs, knowledge and practice patterns of general practitioners and cardiologists in Victoria, BC

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Abstract

Introduction: Testosterone deficiency syndrome (TDS) has been shown to be an independent cardiovascular risk factor and a predisposing factor for metabolic syndrome. As general practitioners and cardiologists primarily care for these patients, we sought to assess their knowledge, beliefs and practice patterns with respect to TDS and cardiac health.

Methods: We distributed a questionnaire to all 20 cardiologists and a cohort of 128 family practitioners in Victoria, British Columbia. Of the 13 questions, 10 assessed knowledge and beliefs on TDS and 3 assessed current practice patterns.

Results: Most respondents believed that TDS is a medical condition (66.7%) and could negatively affect body composition (62%), but a similar majority was unsure whether it was a cardiac risk factor (66.7%). While most believed that testosterone replacement therapy (TRT) could improve exercise tolerance (62%), most were unsure if it was beneficial in cardiac patients. Cardiologists were significantly less likely to believe that TRT was beneficial in preventing recurrent myocardial infarction and improving myocardial perfusion (p = 0.0133, 0.00186, respectively). The vast majority (88%) did not screen cardiac patients for TDS. If a patient was identified as having TDS, only10% of those surveyed would refer these patients to a urologist.

Conclusion: Despite its prevalence in cardiac patients, TDS is not well-understood by general practitioners and cardiologists; they lack knowledge on its deleterious cardiovascular effects. In their role as men's health advocates, urologists should educate our colleagues regarding the correlation between TDS and cardiovascular mortality and risk factors. Limitations of this study include small sample size and restricted geographic scope.

Introduction

Coronary artery disease (CAD) is the leading cause of mortality and morbidity in the western world.[1] Male sex is a significant risk factor for cardiovascular disease; consequently, much of the recent work examining the relationship between the aging male and poor cardiovascular outcomes has revolved around the role of declining testosterone levels.

Testosterone deficiency has a prevalence of 7% in the general population, rising to 20% in elderly males.[2] In older men, testosterone deficiency is associated with an increased risk of death over the following 20 years, independent of multiple risk factors and several pre-existing health conditions.[3] In patients with CAD, testosterone deficiency is common and has a negative effect on survival.[4] Males with CAD have lower testosterone levels than those with normal coronary angiograms of the same age,[5] suggesting that the prevalence of testosterone deficiency is much higher in the CAD population. Men with hypertension, another established risk factor for CAD, have lower testosterone compared to normotensive men.[6-8]

As a conglomeration of major cardiac risk factors, metabolic syndrome (obesity, hyperglycemia/insulin resistance, type 2 diabetes, dyslipidemia, and hypertension) has served as a logical data point to examine the relationship with testosterone deficiency. Recent meta-analyses showed that testosterone levels are generally lower among patients with metabolic syndrome, regardless of the various definitions of metabolic syndrome that are used.[9] Testosterone (total and bioavailable) and sex-hormone binding globulin (SHBG) are inversely associated with the prevalence of metabolic syndrome in men between the ages of 40 and 80, and this association persists across racial and ethnic backgrounds.[10] Lower levels of testosterone and SHBG predict a higher incidence of metabolic syndrome.[10,11]

In Canada, general practitioners provide most of the medical care for men with metabolic syndrome and car-

diovascular disease. In severe cases, or following major cardiac events, cardiologists are also involved. In this project, we assess the knowledge, beliefs and medical management patterns of a representative sample of these physicians on the topic of testosterone deficiency syndrome (TDS) and cardiovascular disease.

Methods

A 13-item questionnaire was designed and reviewed by a urologist and a general practitioner prior to distribution. Questions were grouped into demographics, knowledge, beliefs and exposure, and diagnostic and treatment practices of the responding physician to TDS and cardiovascular health. These questions were in the form of yes/no/unsure and "choose from the following list." All knowledge questions were based on our literature review.

The survey was distributed to all 20 practicing cardiologists in Victoria, British Columbia, Canada, and to a randomly selected cohort of general practitioners. A total of 200 potential subjects were selected at random from the BC College of Physicians and Surgeons database of general practitioners in Victoria, BC. Of these, 59 were excluded due to their scope of practice and 13 were retired. This left a sample size of 128 general practitioners. Surveys were distributed to these physicians with instructions to return the completed surveys by fax.

Chi-squared statistical analysis was undertaken to assess relationships between physician practice (cardiology vs. general practice), physician demographics and responses. Descriptive statistical analysis was also undertaken.

Results

The survey response rate was 65% for cardiologists (13/20) and 30% for general practitioners (38/128). Of the general practitioners, 65.8% of respondents were male and 31.6% female. Their average age was 49.16 years (standard deviation [SD]: 3.14), with 21.58 years of experience (SD: 2.76). Of the cardiologists, 92.3% were male and 7.7% were female. Their average age was 51.15 years (SD: 4.92), with 20.15 years of experience (SD: 5.81).

Of the total respondents, 66.7% believed TDS was a medical condition and 62% believed it could have an adverse effect on body composition; however 66.7% were unsure as to whether it was a cardiac risk factor and 62.7% were unsure if it was a risk factor for CAD. A little over half of the respondents (58.8%) said they were unsure whether testosterone deficiency could contribute to low high-density lipoprotein levels. A subgroup analysis of the general practitioners showed that those with greater than 20 years experience were significantly more likely to believe that TDS was a medical diagnosis than their colleagues with less than 20 years of experience ($p = 0.0432$). There were, however, no statistically significant relationships between physician practice type, gender, age, and these aspects of knowledge and beliefs surrounding TDS and cardiovascular health.

While most physicians believed that testosterone replacement therapy (TRT) could improve exercise tolerance (62%), most were unsure if TRT was beneficial in patients with congestive heart failure (84%), following myocardial infarction (81.3%), or to improve myocardial perfusion (90%). Cardiologists were statistically significantly more likely to believe that TRT was not beneficial in preventing recurrent myocardial infarction and improving myocardial perfusion ($p = 0.0133$ and 0.00186, respectively) than general practitioners. There were, however, no statistically significant relationships between physician gender, age, years of experience and these aspects of knowledge and beliefs surrounding TRT and cardiovascular health.

The vast majority (88%) of physicians did not screen male cardiac patients for TDS. There were no statistically significant relationships between screening practices and physician practice type, gender, age, and years of experience.

Physicians were asked to select the tests they would order in their investigation of a patient with clinical suspicion of TDS. Multiple responses were allowed (Fig.1). The various assays of testosterone were selected almost equally (20, 21, and 21 for total, free and bioavailable testosterone, respectively).

If a patient was identified as having TDS, only 9.8% of those surveyed would refer to a urologist. Of the remaining respondents, 23.5% would treat the individual themselves, 27.5% would refer to an endocrinologist, and 27.5% would both initiate treatment and refer the patient. One cardiologist (1.9%) would refer back to the general practitioner and 9.8% of respondents did not answer this question.

Discussion

Low testosterone levels have been related to increased insulin resistance and cardiovascular mortality,[12] even in the absence of overt type 2 diabetes mellitus. Furthermore, testosterone levels (total and bioavailable) in middle-aged men are inversely correlated with insulin resistance.[13,14] The Massachusetts Male Aging Study (MMAS) demonstrated that low levels of testosterone and SHBG are independent risk factors for the development of type 2 diabetes, a significant cardiac risk factor.[11] In addition, testosterone deficiency has been shown to interfere with normal lipid metabolism. Andropausal men (age 58 ± 7 years) have a higher maximal carotid artery intima-media thickness (CAIMT)[15] compared to controls.[16] After age adjusting, serum testosterone has been shown to be inversely related to CAIMT.[15] There is an inverse linear correlation between body mass index (BMI) and wait-to-hip ratio with testosterone and insulin-like growth factor-1 levels.[17]

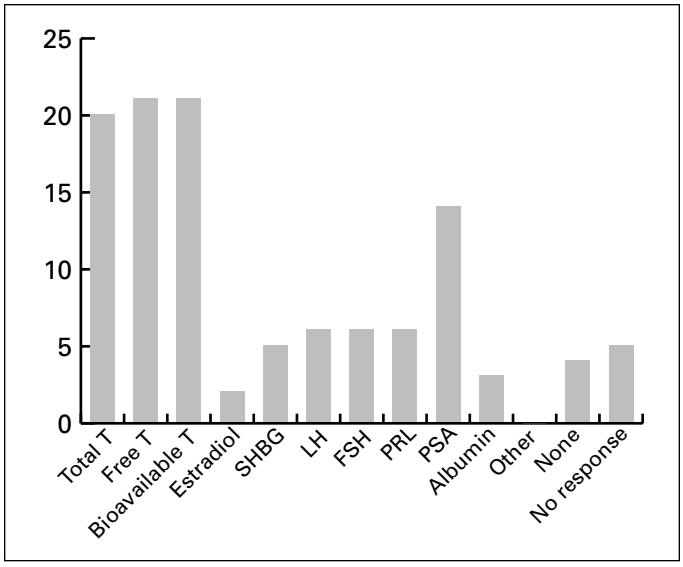

Fig. 1. Laboratory tests chosen by surveyed physicians in the investigation of suspected testosterone deficiency syndrome. T: testosterone; SHBG: sex-hormone binding globulin; LH: luteinizing hormone; FSH: follicle-stimulating hormone; PRL: prolactin; PSA: prostate-specific antigen.

Currently, there is no consensus as to what serum level of testosterone denotes a significant clinical deficiency. It is noted that the same testosterone test assay should be utilized in the same individual for clinical decision-making. Currently, testosterone deficiency is diagnosed based on physical symptoms of androgen deficiency, monitoring testosterone levels, and tracking the clinical response to TRT.[18]

It has been suggested that testosterone replacement be utilized as secondary prevention in patients with vascular disease,[19] as it has beneficial effects on virtually all of the coronary risk factors and improves the ischemic threshold, quality of life and depression scores in patients with symptomatic coronary disease.[19] For general practitioners, screening for testosterone deficiency in patients with CAD is of value as it allows for testosterone replacement, which is one of the few secondary prevention maneuvers shown to improve patients' quality of life.[19]

Testosterone supplementation for 1 year in hypogonadal men has been shown to cause a significant improvement in body weight, BMI, waist size, lipid profile, and C-reactive protein levels.[20] TRT for 3 months in hypogonadal men with type 2 diabetes significantly improved fasting insulin sensitivity, fasting blood glucose and glycated hemoglobin.[21] Testosterone replacement can improve angina symptoms and delay the onset of cardiac ischemia, likely through a coronary vasodilator mechanism.[22,23]

The effects of testosterone deficiency on cardiovascular disease are reinforced by the American Heart Association recommending that men on androgen deprivation therapy (ADT) for prostate cancer should receive periodic follow-up with their family physician to monitor blood pressure, lipid profile and glucose levels.[24] ADT is associated with an increased risk of cardiovascular events, including myocardial infarction and cardiovascular mortality.[8,25-28] ADT significantly increases fat mass, decreases lean body mass,[29,30] increases fasting plasma insulin and decreases insulin sensitivity[31] and increases serum cholesterol and triglyceride levels.[29,32,33]

There are limitations in this current study. Firstly, the study was conducted in a single city in British Columbia. While there is a satellite medical campus, Victoria is not a large academic centre and so physician knowledge and beliefs in this city may not be generalizable to other locations. In addition, this study had a relatively small sample size. Despite a 65% response rate among the cardiologists and a 30% rate among the general practitioners, only 13 cardiologists and 38 general practitioners responded. Despite these limitations, this study provides important information regarding the knowledge, beliefs and practice patterns of physicians caring for patients with cardiac disease.

The role of the urologist in this area is still evolving. As men's health advocates, urologists should be involved in leading medical education to inform relevant physicians on the screening, diagnosis, and treatment of cardiovascular disease and could initiate testosterone screening as appropriate. There is evidence that that TRT can benefit patients, so testosterone levels should be considered as part of the cardiovascular disease evaluation. Among the surveyed physicians, there was uncertainty as to whom these patients should be referred for management. Endocrinologists were the most common choice for referral, though urologists often manage testosterone deficiency. In their role as men's health advocates, urologists may wish to be more involved in the care of these patients.

Conclusion

Despite being remarkably common in cardiac patients, TDS is not well-understood in general practitioners and cardiologists; they lack knowledge as to its significant deleterious cardiovascular effects. In their role as men's health advocates, urologists should consider promoting continuing medical education seminars to inform other relevant medical specialists regarding the correlation between TDS and cardiovascular mortality and risk factors.

Competing interests: Dr. Wallis, Dr. Brotherhood and Dr. Pommerville all declare no competing financial or personal interests.

This paper has been peer-reviewed.

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