

Erectile Dysfunction and Coronary Artery Disease-the Practice Points

Coronary artery disease (CAD) is a leading cause of morbidity and death. Erectile dysfunction (ED) and Coronary artery disease (CAD) share a common pool of risk factors. Risk factors such as Diabetes, Hypertension, smoking and alcohol consumption display a significant co-relation with ED; and these patients are almost three times more likely to have a coronary blockade when compared to those not reporting ED. A complex interplay between Atherosclerosis, Vascular inflammation and endothelial dysfunction mark the pathophysiological cascade that underlies these disorders, with endothelial dysfunction being the major component affecting different vascular beds of various diameters. Endothelial dysfunction plays a key role in the progression of atherosclerosis, contributing to exaggerated intimal proliferation and dysregulation of the inflammatory processes.

It has been well studied that patients with ED tend to develop a severe CAD with multiple vessel involvement compared to those without ED. This concurrence between ED and CAD, therefore, makes a strong ground for routine inquiry into the sexual history of young males with one or more cardiovascular risk factors. Furthermore, it forms an important component in quality of life of men.

Keywords: Erectile dysfunction • Coronary artery disease • Diabetes Mellitus • Hypertension

Abbreviation List:

ED: Erectile Dysfunction; CAD: Coronary artery disease; CV: Cardiovascular; DM: Diabetes Mellitus; HT: Hypertension; NO: Nitric Oxide

Introduction

Erectile dysfunction (ED) is the inability to achieve and maintain erection for satisfactory sexual intercourse and its global prevalence ranges from 2 to 86%. Normal erectile function is primarily a vascular event that relies heavily on endothelially derived, nitric oxide-induced vasodilation. Atherosclerosis, being a predominantly systemic disease, it is fairly reasonable to expect penile atherosclerosis and resultant ED to occur in patients with CAD [1].

There is no non-invasive method, clinical sign or laboratory test capable of detecting all individuals who will develop CAD. Nevertheless, ED may be an early clinical marker of CAD with association to the degree of ED and the severity of coronary artery disease in a large proportion of men.

It would be important to consider that men who develop erectile dysfunction (ED) often feel embarrassed, ashamed, and frustrated [2]. Embarrassment is often the universally cited reason for not opening up

on the topic with their doctor. Availability of good treatment options and society's new openness to this fairly common issue has significantly removed some of the stigma, but for many men, ED is still a heartbreaking affair, quite literally indeed [3].

ED is not uncommon among young males with conventional CVD risk factors and requires building a rapport with the patient to open up on such a sensitive topic [2]. Moreover, most patients would never identify that their ED could even be remotely associated with cardiovascular disease, which could encourage a significant underreporting of ED.

What can explain the correlation between ED and CAD

Heart attacks and ED are both circulatory diseases. But, while cardiac patients have cholesterol-laden plaques blocking their coronary arteries, men with ED don't have plaques in their penile arteries. Still, the

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two disorders share a common mechanism. The answer is NO! [3].

The arteries of the heart, the penis, and the rest of the body have a thin inner lining of endothelial cells. These cells produce nitric oxide (NO), a chemical that helps keep the artery's lining smooth and healthy. Nitric oxide also relaxes the muscle cells in the artery's middle layer, allowing it to widen and increase the flow of blood. It's important to the heart, permitting the cardiac muscle to get more oxygen-rich blood when it's working hard. And it's equally important to the penis, since a good erection requires a six-fold increase in the amount of blood to the organ. Moreover, NO also has a crucial role in allowing neuronal communication with one another, thus enabling the impulses of desire to communicate with the arteries of the penis [3].

Risk factors promoting both CAD and ED

Erectile dysfunction is associated with significant changes in established cardiovascular risk factors such as fasting lipids, fasting glucose, body mass index (BMI), C-reactive protein (CRP) and serum homocysteine [2]. Diabetes Mellitus Type 2 and Hypertension seemed to be primary culprits with ED and the prevalence of ED further increases with the duration of DM and HT [1].

Diabetic men with impotence have dysfunctional neurogenic and endothelium-dependent penile smooth muscle relaxation. While the precise mechanisms have not been clearly defined, endothelial damage may either decrease basal release of NO or may lead to its increased breakdown. Furthermore, eNOS (Nitric Oxide Synthase) activity may be attenuated by accumulation of NOS inhibitors and alteration in NO formation due to adverse effects of advanced end-product glycosylation. In addition to endothelial alterations, vascular smooth muscle cells appear to have a blunted response to NO. Additionally, increased plasma and corporal body endothelia levels have been seen in diabetic men with ED which plays a key factor in maintaining corpus cavernosal smooth muscle tone.

Hypertension-associated endothelial dysfunction may be related to eNOS gene variations such as changes in the cyclooxygenase (COX) pathway as increased COX activity can lead to increased ROS (Reactive Oxygen species) [1]. However, more often, hypertension plays an etiologic role in ED beyond its correlation with endothelial dysfunction. Structural alterations with vascular and corporal remodeling occur that reduce vasodilatory capacity including vascular smooth muscle proliferation and fibrosis.

Additionally, although Alcohol consumption in small amounts improves erection and increases libido because of its vasodilatory effect and anxiety suppression; its long-term use can result in hypogonadism and polyneuropathy resulting in sexual dysfunction [2]. Tobacco, on the other hand, has an adverse effect on erectile function which is well documented in medical literature, and is predominantly mediated through smoke-induced inhibition of neuronal

and endothelial nitric oxide synthase (NOS), damage to the vascular endothelium, and impaired NOS-mediated vasodilation.

Significance of association between ED and CAD

Not long ago, patients and their doctors viewed ED as a psychological disorder which in fact accounts for only 15% of cases. Many now think of ED as a urological or endocrinological issue, but the root problem is much more than previously anticipated [3].

There are various determinants to support ED as a predictor of CAD. The common endothelial pathology underlying both ED and CAD plays the most significant role. Moreover, a significant proportion of men with ED exhibit early signs of CAD and it has also been observed that men with pre-existing ED may develop more severe CAD than those without ED, in fact, patients with ED were almost three times more likely to have coronary vessel blockade involving at least one coronary compared to the non-ED patients [2]. The interval between the onset of ED symptoms and the occurrence of CAD symptoms is estimated at 2–3 years while that with a cardiovascular event is at 3–5 years [4,5].

Sexual symptoms are expected to occur at a mean of 38.8 months prior to their cardiac symptoms [6]. In a study of patients with vasculogenic ED, Shamloul et al found that a penile peak systolic velocity <35 cm/s had a specificity of 100% for predicting Ischemic Heart Disease [7].

ED may also be a harbinger of other vascular disease. Montorsi et al. review reported that in patients with ED, the incidence of positive exercise stress testing ranged from 5 to 56% [8].

ED was also found to be associated with subclinical left ventricular dysfunction, increased incidence of asymptomatic CAD, increased risk for CAD morbidity and mortality. The severity of ED was also found to be correlated with angiographic severity and complexity of CAD [9].

These discoveries have created advocates for considering ED as a penile angina [1].

Investigations and Interventions

Given the fact that ED precedes the clinical presentation of CAD, routine enquiry into this aspect of the personal history of a young male with one or more conventional cardiovascular (CV) risk factors could aid in early diagnosis of CAD.

Despite there being conclusive evidence linking ED with endothelial dysfunction in the penis – considered as the barometer of endothelial health as it was pronounced by McCollough [10], the routine questioning on this aspect does not seem to happen in clinical settings. To support this statement, as many as 62% of the primary care physicians in Nigeria would not elicit a sexual history unless the patient

brought it up [11], while in India it seems that this percentage is likely nil.

Majority of males with ED resort to over the counter phosphodiesterase inhibitor (PDE-I) treatment as and when required, while a significant proportion resorted to traditional healers and AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy) practitioners for relief [2].

Therefore, all men with ED should preferably undergo a thorough medical assessment, including testosterone, fasting lipids, fasting glucose and blood pressure measurement [4]. Following this initial workup, they should be stratified according to the risk of future cardiovascular events based on their risk factors. Those patients who have been identified at a high risk of cardiovascular disease should be further evaluated by stress testing with selective use of computed tomography (CT) or coronary angiography [4].

We should advocate such patients to improve their cardiovascular health such as adequate weight loss and increased physical activity – both of which have been reported to improve erectile function. In men with ED, hypertension, Diabetes and hyperlipidemia should be treated aggressively, after bearing in mind the potential side effects.

However, it is vital to note that management of ED is only secondary to stabilizing cardiovascular function and controlling cardiovascular symptoms and exercise tolerance should be established prior to initiation of ED therapy. Clinical evidence supports the use of phosphodiesterase 5 (PDE-5) inhibitors as first-line therapy in men with CAD and comorbid ED and those with diabetes and ED. Mechanisms of benefit of PDE5 inhibitors include pulmonary and systemic vasodilation, increased myocardial contractility, reduced large artery stiffness and wave reflections, improved endothelial function, and reduced apoptosis, fibrosis and hypertrophy [12]. These pills are safe in men with stable coronary artery disease and well-controlled hypertension, but none can be used by men taking nitroglycerin or other nitrate medications. And while the ED pills are fine for men taking most blood pressure medications, they must be used very cautiously (if at all) by men taking alpha blockers for hypertension or Benign Prostatic Hyperplasia [13].

Finally, a routine review of cardiovascular status and response to ED therapy should be performed at regular intervals.

Conclusion

Erectile dysfunction is associated with increased all-cause mortality primarily through its association with CAD mortality. In their meta-analysis, Dong and his colleagues concluded that ED significantly increases the risk of CAD, stroke and all-cause mortality. This increased risk related to ED, was independent of other CAD risk factors.

The risk of experiencing a cardiovascular event within a 10-year timeframe is increased by 1.3-1.6 times in men with ED vs. men without ED.

Symptoms of ED may precede clinical cardiac manifestations, and should prompt a cardiac risk assessment. A comprehensive approach to cardiovascular risk reduction improves overall vascular health, including sexual function. In addition, patients should be systematically screened for ED as a part of periodic examinations. This would guarantee an early detection of modifiable cardiovascular risk factors, or already existing cardiovascular disease. Moreover, adequate sexual counseling would aid in improving the quality of life and increases adherence to medication as well.

The main focus henceforth should be to prevent ED and vascular disease progression through carefully observed pharmacological interventions and life style modifications to promote cardiovascular health. Management of ED requires a collaborative approach and the role of the cardiologist is pivotal.

References

- Rodriguez FJJ, Dashti RA, Schwarz ER. Linking erectile dysfunction and coronary artery disease. *Int J Impot.* 17: S12–S18 (2005).
- Desai M, Naik G, Kamat US, et al. Concurrence of erectile dysfunction and coronary artery disease among patients undergoing coronary angiography at a tertiary Medical College Hospital in Goa. *Ind Heart J.* 72(2): 123-125 (2020).
- Harvard Men's Health Watch, Harvard Health Publishing, ED and coronary artery disease: Surprising bedfellows. (2008).
- Ravi S, Phanikrishna S, Reddy BS. Association between erectile dysfunction and coronary artery disease and its severity. *Indian Heart J.* 65(2): 180-186 (2013).
- Kumar J, Bhatia T, Kapoor A, et al. Erectile dysfunction precedes and is associated with severity of coronary artery disease among Asian Indians. *J Sex Med.* 10(5): 1372-1379 (2013).
- Nascimento ER, Maia ACO, Pereira V, et al. Sexual dysfunction and cardiovascular diseases: a systematic review of prevalence. *Clinics (Sao Paulo).* 68(11): 1462–1468 (2013).
- Shamloul R, Ghanem HM, Salem A, et al. Correlation between penile duplex findings and stress electrocardiography in men with erectile dysfunction. *Int J Impot Res.* 16(3): 235-237 (2004).
- Montorsi F, Briganti A, Salonia A, et al. Erectile dysfunction prevalence, time of onset and association with risk factors in 300 consecutive patients with acute chest pain and angiographically documented coronary artery disease. *Eur Urol.* 44: 360-364 (2003).
- Mohammad M, Al-Daydamony, Shawky A, et al. Erectile dysfunction severity as a predictor of left main and/or three-vessel disease in acute coronary syndrome patients. *Ind Heart J.* 7(S3): S56-S59 (2018).
- McCullough AR. The penis as a barometer of endothelial health. *Rev Urol.* 5(S7): S3-S8 (2003).
- Ariba AJ, Oladapo OT, Iyaniwura CA, et al. Management of erectile dysfunction: perceptions and practices of Nigerian primary care clinicians. *S Afr Fam Pract.* 49(9): 16 (2007).
- Vlachopoulos C, Jackson G, Stefanadis C, et al. Erectile dysfunction in the cardiovascular patient. *Eur Heart J.* 34(27): 2034-2046 (2013).
- Schouten BW, Bohnen AM, Bosch JL. Erectile dysfunction prospectively associated with cardiovascular disease in the Dutch general population: results from the Krimpen Study. *Int J Impot Res.* 20(1): 92-99 (2008).