Environmental problems and their relationship to cardiovascular disease

Los problemas ambientales y su relación con las enfermedades cardiovasculares

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Received: June 09, 2013
Accepted: July 04, 2013

Key words: Environmental problems, Cardiovascular diseases

To the Editor:
The environmental issue has become part of everyday life: we live in the environment and are part of it, therefore “everything that happens on Earth, will affect the children of the Earth”\(^1\); environmental problems are widely known, and its effects on human health are asserted and discussed.

Years ago, and in several publications, we stated\(^2\) that human health is a reference point for environmental monitoring and the formulation of policies in this regard. Ultimately, with regard to global change, the biological integrity of humankind, its psychological well-being and survival, are at stake. Humans are an important part of the environment; therefore, their health and well-being are related to the fact of keeping habitable the whole planet\(^2\).

There are numerous classifications of environmental problems. As a common denominator they all include: environmental pollution, global climate change, stratospheric ozone depletion, loss of biodiversity and soil degradation.

Cuban environmental problems, reported in the Estrategia Ambiental Nacional de Educación Ambiental\(^3\), are: soil degradation, damage to the forest cover, pollution (due to liquid and solid waste, air emissions, noise pollution, chemicals and hazardous waste), the loss of biological diversity, lack of water and difficulties with its availability and quality, and climate change impact.

The relationship between some environmental problems and cardiovascular disease has been studied in different geographical regions\(^4,5\). In Cuba, there are studies which are primarily related to the change of weather patterns and its impact on the increase in cardiovascular disease.

Air pollution

The main sources of air pollution in Cuba are: automotive transport (which stands out for its poor technical condition and poor fuel quality), some industries near densely populated areas, noise, dust (especially in winter/dry season) and smoking\(^3\).

Pollution, specifically air pollution, and its relationship to cardiovascular disease, is determined by the quality of the air, and it is usually measured by the concentrations of pollutants such as nitrogen dioxide (NO\(_2\)), ozone (O\(_3\)), particulate matter (PM) and sulfur dioxide (SO\(_2\)). The measuring of particulates identifies two superimposed categories: those ≤ 10 microns in diameter (PM 10) and those ≤ 2.5 microns in diameter (PM 2.5). The smallest ones are considered the most harmful to health as they can penetrate deep into the lungs\(^5,6\).

The American Heart Association (AHA) has concluded that an increase in fine particles of 10 mg/m\(^3\), for a 24-hour period, is associated in the short term with a 0.31 % increase in cardiopulmonary morbidity and mortality. A 10 mg/m\(^3\) increase in annual average exposure to PM 2.5 was associated with a 6 % increase in long term cardiopulmonary mortality\(^7\). Some groups...
are more affected by air pollution, such as communities of low socio-economic status, the elderly and those suffering from other pre-existing diseases\textsuperscript{5-7}.

Moreover, during the 2008 Beijing Olympic Games, researchers from the University of Southern California (USC) found biological evidence that even a short-term reduction of the exposure to air pollution improves cardiovascular health. The results of the study were published in the \textit{Journal of the American Medical Association}\textsuperscript{4}. In this regard, Dr. Junfeng Zhang, one of the authors of the study and a professor at the Keck School of Medicine of the USC stated: “We believe this is the first major study that clearly shows how changes in the exposure to air pollution affect cardiovascular disease mechanisms in healthy young adults.”

It is said that there is a combination of direct toxic effects on the autonomic nervous system which causes systemic inflammation, which may cause not only cardiac arrhythmias or precipitate coronary thrombosis, but may also be mediated by some of the effects on behavior (highly contaminated environments may promote car use and discourage physical activity, although this is not proven)\textsuperscript{4-6}.

One of the most common polluting gases in our environment is carbon monoxide (CO), produced by the incomplete combustion of gas, oil, coal, tobacco or timber, provided that the equipment that burn them are not working properly; it is also produced by stopped vehicles with the engine running. Its toxic effects are caused by tissue hypoxia resulting from increased formation of carboxyhemoglobin (COHb), because CO has an affinity with hemoglobin 200 times higher than oxygen, and the heart is one of the most sensitive organs. Induced acute cardiac disorders have been studied repeatedly and their characteristics have been described considering the exposure time, breathing frequency, age and previous diseases. While in healthy subjects the cardiovascular effects appear when the concentration of COHb is 35-40%, in patients with ischemic heart disease a COHb concentration of 2-5% may cause angina episodes, during physical exposure\textsuperscript{5,6}. In patients with pre-existing conditions, fatal myocardial infarctions have been observed with COHb concentrations of 20 %\textsuperscript{6}.

The effects of exposure to low concentrations of CO in the long term are still controversial\textsuperscript{7}. Increased mortality due to cardiovascular disease in people who work in tunnels may be best explained by acute exposure rather than by the chronic effects of carbon monoxide\textsuperscript{5,7}.

The difficulties to clarify the mechanisms related to air pollution and cardiovascular disease are mainly due to the complex and variable composition of pollution, and the difficulty to develop methods that connect pollution components and that represent confounding factors for relevant people: smoking, socio-economic factors and factors related to the modification of individual exposure (the time spent at home, at work and traveling)\textsuperscript{8}.

\textbf{Noise}

Moreover, noise, also known as noise pollution, has been known to cause loss of hearing for a long time. Its best known relationship with cardiovascular disease is with hypertension\textsuperscript{9}. The results of epidemiological studies do not explain clearly the adverse cardiovascular effects of chronic exposure to noise, environmental noise or at the place of work\textsuperscript{9-11}. Experimental knowledge on the hormonal effects of stress and the changes in peripheral vasoconstriction, on the one hand, and the observation that a high level of noise at the workplace (>85 dBA) induces the development hypertension, on the other hand, allows the inclusion of noise as a nonspecific stress stimulus in a model of multifactorial risk of cardiovascular disease, with a high degree of biological reliability\textsuperscript{11}.

Stress studies have shown that although the increases in blood pressure during work are related to noise exposure, blood pressure level itself depends on a complex association of environmental factors and factors related to personality\textsuperscript{9-11}. Therefore, it is an urgent task to study the effect of multiple loads at the workplace and to clarify the cross-effects (most of them are unknown until now) between the combination of exogenous factors and the various endogenous risk characteristics.

The studies are incipient, considering the complexity of the environmental issue and the many direct and indirect ways in which it relates to cardiovascular disease. It is the task of cardiologists to continue investigating this matter and incorporate the results into their practice, so that patients may know the risks and adopt the appropriate behavior.

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To the Editor:

Erectile dysfunction (ED) is an extremely common disease, which increases its incidence with age and affects moderately/severely about 35% of men between 40 and 70 years of age. ED has multiple causes, and those of vascular origin are the most frequent ones. This major cause of ED accounts for up to 70% of this sexual disorder in men over 40, and is associated with other cardiovascular (CV) risk factors such as dyslipidemia, hypertension, diabetes mellitus, obesity, among others. Also, ischemic heart disease, or more generally, CV disease: predictor of cardiovascular disease

Disfunción eréctil: factor predictor de enfermedad cardiovascular

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Received: May 09, 2013
Accepted: July 04, 2013

Key words: Erectile dysfunction, Cardiovascular disease, Endothelial dysfunction
Palabras clave: Disfunción eréctil, Enfermedad cardiovascular, Disfunción endotelial
disease shows a clear increase in prevalence with age. Therefore, it is natural that both are associated. But this association is stronger than would be expected by a simple association with age. Indeed, ED and CV disease share common risk factors and mechanisms. It is becoming increasingly accepted that ED is caused, in most cases, by endothelial dysfunction, and it is known that this is an early alteration in atherosclerotic disease. 1-3

The association between ED and coronary artery disease (CAD) has been known for some years, and even ED is considered a predictor of CAD. When adjusting the risk for age, smoking and obesity, patients with ED have twice the danger of having an acute myocardial infarction than control patients, and it is the most powerful predictor of CAD (OR = 14.8), so it occurs early (average 39 months before) in 70% of patients with symptoms of CAD. 1

According Marconi et al.2, Pritzker et al. found 28 patients with positive stress test for ischemia in a series of 50 men (age range 40-60 years) with ED and no other CV symptoms, of which 20 had positive coronary angiography. This author concluded that erection could be considered as a stress test of the cavernous arteries and that ED, as such, was an early predictor of endothelial dysfunction and CAD.

In a prospective study, Montorsi et al.4 evaluated a series of 300 men with symptomatic CAD, which was documented by coronary angiography, and 49% of them had some degree of ED at the time of the interview. However, the most important aspect was that in 67 % of these men ED had preceded the onset of coronary symptoms with an average time of 39 months, between the beginning of ED and the coronary event. This study reinforced the idea that in asymptomatic men, from the CV point of view, the first manifestation of arterial dysfunction may be the ED, and this should be an early warning to purposely assess the coronary arteries.4 5

All these epidemiological evidences show that ED is a primary manifestation of endothelial dysfunction, and that, in a significant percentage of men suffering from it, it has a time span which enables its classification as a predictor of CAD.

Because penile arteries have a smaller diameter than coronary arteries, erectile sexual dysfunction appears first as clinical manifestation of endothelial damage, and several months later coronary dysfunction appears. This explains why the penis is considered as a barometer endothelial health. 3

The ED generally appears about two or three years before the manifestation of ischemic heart disease and, therefore, its detection could allow therapeutic measures that could prevent more serious CV complications. Conversely, more than two-thirds of men with CAD have, when questioned, a history of ED. 5 7

Endothelial dysfunction contributes to the atherosclerotic process, may also be involved in the pathogenesis of ED and promotes the development of coronary syndromes (stable, unstable and Prinzmetal's angina). Besides, CV risk factors are prevalent in patients with ED and correlate with endothelial dysfunction, hypertension, hypercholesterolemia, diabetes mellitus, smoking and age. 8

The vascular endothelium is of extraordinary importance in biological processes such as penile erection, inflammation, platelet aggregation, vascular smooth muscle proliferation, and modulation of vascular tone and flow. 6 8

This is an issue recently reported in Cuba; the first publication in this regard was Dr. Rivas Estany’s editorial in the Revista Cubana de Cardiología y Cirugía Cardiovascular, which refers to the Consensus Meeting on Cardiovascular Disease and Sexuality held in Havana. It is a new line of research that deserves our attention, as it is likely to have a major impact on the early diagnosis and prevention of coronary artery disease.

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