Ischemic heart disease: prevention should begin in childhood

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Abstract

Introduction: ischemic heart disease has gained importance in developing countries. Although clinical symptoms of the disease just appear during adulthood, prevention should begin in childhood, before the establishment of risk factors.

Objective: to review the main risk factors for ischemic heart disease and preventive strategies during childhood.

Methods: Medline review between 1985 and 2001, and key references from the studies evaluated.

Results: preventive interventions that may start in childhood are described for risk factors such as hyperlipidemias, obesity, smoking and systemic hypertension. Pediatrician’s main strategy is the promotion of healthy habits. Results of early diagnosis and efficiency of interventions are discussed.

Conclusion: recent studies have shown that life styles potentially associated with atherosclerosis begin during childhood. Thus, early intervention regarding these life styles could have impact on adult behavior, reducing the prevalence of this pathologic condition.


Introduction

Ischemic heart disease is one of the major health problems worldwide, accounting for a significant percentage of total mortality in current days. Traditionally, ischemic heart disease is believed to originate from a combination of genetic, socioeconomic, and environmental factors. The latter represent the lifestyle during adulthood.

The idea that atherosclerosis begins in childhood is not new. It was discovered by Saltykow, in 1915, in a study of autopsied young patients.1

Only in 1965, however, atherosclerosis began to be recognized as a pediatric disorder, when risk factors for ischemic heart disease were identified in children.1

The main premise of preventive pediatric cardiology was based on these studies. According to these studies, lifestyles that potentially cause atherosclerosis have their onset in childhood. Tracking is the persistence of a given risk factor up to adult life, for instance, the correlation between the levels of arterial blood pressure measured during childhood and the values observed in adult life.
Therefore, the early intervention in these lifestyles may influence behavior in adults, thus reducing the prevalence of ischemic heart disease.2

The aim of this study is to review the main risk factors among children which cause an impact on adult life, outlining preventive interventions in the pediatric and pediatric cardiology areas.

**Nutritional factors and lipid profile**

Some studies suggest a nutritional origin for atherosclerotic disease.3 In 1991, the National Cholesterol Education Program (NCEP) Expert Panel recommended that the general population and each child adopt an approach to reduce the risks of coronary disease in adult life. The strategy to be used among children is to offer them a well-balanced diet, paying special attention to the restriction of the intake of saturated fat and cholesterol. However, nutritional restriction without proper supervision in children with hypercholesterolemia may cause deficiencies and inadequate growth (stunting).3 The individualized study of the pediatric population aims at the identification of children who are predisposed to hypercholesterolemia, based on positive family history. This family history includes grandparents with evidence of atherosclerotic disease or early hemorrhagic cerebrovascular disease (before the age of 55 years for men and before the age of 65 years for women) or cholesterol levels greater than 240 mg/dl.2 There are also other indicative signs of additional risk, such as obesity, smoking, and unbalanced diet.

NCEP defined the levels of total cholesterol regarded as acceptable (less than 170 mg/dl) or high (greater than or equal to 200 mg/dl) for North-American children; these values correspond approximately to the 75th and 95th percentiles for age. The probability of a child with total cholesterol greater than the 95th percentile to keep such values in adult life is high, reaching up to 80 % in some studies. The 95th percentile for a four-year old (200 mg/dl) corresponds to approximately 260 mg/dl in an adult, and is definitely associated with increase risk for ischemic heart disease.4,5

The necessity to control the level of total cholesterol is clear in children at risk for early coronary artery disease or hypercholesterolemia, but population tracking is still controversial, especially with regard to the effectiveness of therapy.6,7

Current studies suggest that an important difference in the concentration of lipoproteins in children may explain the difference in deaths caused by coronary artery disease (CAD) in adult life. Evidence of epidemiological and laboratory studies support the hypothesis that the increased levels of total cholesterol and LDL cholesterol predispose to CAD, while high levels of HDL cholesterol reduce the risk in adults.8

In addition, high levels of LDL and VLDL cholesterol and low levels of HDL cholesterol in children and young adults prove that there is an association with greater risk of early atherosclerotic disease.9-12

It is common knowledge that lifestyle, for example, diet and anthropometric factors may influence the content of lipoproteins. With regard to HDL cholesterol, some of the studied factors include body fat content, physical activity, and hormonal make-up.13-15

High levels of lipoprotein A (LPa) are an independent risk factor for CAD and cerebrovascular disease in young adults, since this lipoprotein plays an important role in the etiopathogenesis of thrombosis in children.16

**Obesity**

The prevalence of obesity among children has been rising in industrialized countries, and has been attributed especially to environmental and sociocultural factors, such as unhealthy diet with high fat content and sedentary life.17 In Brazil, although malnutrition is still highly prevalent, the incidence of obesity and overweight has been rising significantly. Studies show that approximately 23% of children between 6 and 12 years and 21% of those aged between 12 and 17 years are obese. About 50% of obese children have other risk factors for cardiovascular diseases.18

In the United States, the percentage of obese children between 6-11 years (body mass index greater than the 95th percentile) increased from 3.9% to 11.4% in males and from 4.3% to 9.9% in females in studies conducted in 1963-5 and 1988-9.19

It is important to control weight during childhood, since obesity acquired during this period tends to persist in adult life.20-23 The chance of childhood obesity continuing in adult life is related to the length and severity of the disease. Remission rates decrease with age, and the increased severity enhances the risk of persistence. Approximately one third of obese adults used to be obese children and, when obesity was severe, this percentage increased from 50% to 75%.24

Obesity is not considered a direct risk factor for coronary atherosclerosis, but in general, it is accompanied by arterial hypertension and diabetes mellitus.17,25 This way, weight control may potentially reduce the prevalence of at least two important risk factors. Current studies have shown that insulin resistance is an intermediary factor between obesity and systemic arterial hypertension, noninsulin-dependent diabetes and CAD.26,27

Obesity is associated not only with nutritional factors, but also with behavioral disorders. These disorders are characterized by a change in current leisure patterns; in other words, old and healthy children’s activities have been gradually replaced with excessive time spent on TV watching, computer, and electronic games. In addition to
reduced physical activity, this sociocultural transformation promotes an unnecessary increase in calorie intake.\textsuperscript{28,29}

Overweight children are at greater risk for psychological disorders. Six year olds internalize social messages that overweight is undesirable and that overweight children may be rejected and become socially secluded or develop a distorted body image. This social burden affects school performance and interpersonal relationships. Psychological and psychosocial problems that arise at this age may persist in adult life.\textsuperscript{19}

**Sedentary behavior**

Although some studies reveal that adolescents engaged in more physical activities tend to stay more active when they are young adults, other authors show that physical activity in childhood provides no cardiovascular protection if it is not associated with keeping an active lifestyle in adulthood.\textsuperscript{1,30} Some works show that this physical activity, regardless of intensity, may be more important and a more real target than trying to determine a beneficial intensity. It is the physical activity other than the aerobic activity that is usually associated with good health.\textsuperscript{31}

It is important to underscore that childhood is the ideal period for motivating children to practice physical activities. If this habit is formed during childhood, there is a great probability that it is valued and maintained in adult life.\textsuperscript{1,30}

**Systemic arterial hypertension**

Although systemic arterial hypertension may start in childhood, the association between slight or moderate increase in blood pressure during childhood and enhanced risk of high blood pressure in adulthood is not clearly defined.

There is a great variation of arterial blood pressure from person to person during the growth stage, but there is some evidence of tracking.\textsuperscript{32} Arterial blood pressure should be checked and recorded during routine preventive examination in children older than three years, and also in all emergency care. Adolescents who have hypertensive parents are at a greater risk and should be followed up closely.\textsuperscript{33} The necessity to evaluate arterial blood pressure on a regular basis during childhood is justified because systemic arterial hypertension can be easily detected on physical examination, and properly treated, preventing long-term consequences. Since systemic arterial hypertension is often asymptomatic, the best way to diagnose it is the careful survey on pediatric examination.

The levels of reference for the definition of systemic arterial hypertension in adults were clearly established with basis on studies that showed increased risk associated with high blood pressure. In children, these reference values originate complex tables according to age, structure and weight. Among these, the most frequently used include the Task Force Report on High Blood Pressure in Children and Adolescents, from National Heart, Lung, and Blood Institute and the American Academy of Pediatrics.\textsuperscript{34}

On top of that, the prevalence of systemic arterial hypertension in childhood is higher than other routinely traced conditions. In a study carried out in Belo Horizonte, the prevalence of systolic or diastolic arterial blood pressure values greater than the 90th percentile for age, gender, and height was 9%. Less than 50% of 1,005 assessed students (mean 11.5 years) had had their blood pressure checked prior to the study.\textsuperscript{35}

The implementation of a healthy diet, the maintenance of ideal weight, and the regular practice of physical activity should be encouraged in children as a primary method to prevent systemic arterial hypertension.\textsuperscript{30}

**Smoking**

Besides the association with higher risk for cardiovascular diseases and other pathologies, smoking is one of the risk factors in which intervention during childhood is most clearly necessary and effective. It is possible to argue that, for instance, the indication of a special diet for the prevention of hypercholesterolemia may cause excessive worry on the family and result in an inadequate diet in terms of children’s nutritional requirements; however, it is hard to imagine the deleterious effects of antismoking campaigns. Clinical analyses may point out the passive and direct effects of smoking on children. Studies suggest that the passive exposure to tobacco is related to low levels of serum HDL cholesterol, combined with a significant dose-dependent endothelial dysfunction.\textsuperscript{36,37} In terms of direct effects, there is some evidence showing that mild obstruction of airways and growth retardation of the lung function in adolescents are related to smoking.\textsuperscript{38}

**Relationships between risk factors**

There is some evidence that obese children (6-9 years) have higher levels of insulin, tissue plasminogen activator (t-PA), plasminogen activator inhibitor (PAI-1) and fibrinogen in comparison with the control group.\textsuperscript{39} High serum levels of fibrinogen are associated with enhanced risk of coronary disease. Adverse factors in childhood, characterized by reduced growth, have been associated with a high level of fibrinogen in adults. Along with other hemostatic factors, fibrinogen may produce atherosclerotic and thrombotic disorders by affecting platelet aggregation, blood viscosity, and formation of foam cells.\textsuperscript{40}
Alternatively, the association between fibrinogen and cardiovascular disease may be a consequence rather than a cause of the pathological process, perhaps due to an inflammatory response to progressive endothelial injury.

The influences of low socioeconomic status and risk for disease in adults have been recognized for many years; several studies show that socioeconomic status is correlated with morbidity and mortality in adult life due to every type of causes, including cardiovascular disease. In a recent study conducted by Gerber & Zielinsky, patients who belonged to a socioeconomically privileged group presented relevant results in terms of cholesterol and LDL cholesterol levels, but not in terms of obesity, arterial blood pressure, HDL cholesterol and triglycerides. Forsdahl showed that deprivation in the first years of life followed by precarious conditions in subsequent years produces a higher risk for coronary disease. Children of socioeconomically privileged families are believed to be less prone to smoking, have lower incidence of bronchopulmonary disease and angina, lower levels of diastolic blood pressure and lower body mass index. Some of these factors determine the risk for cardiovascular disease and other causes of death.

Breastfeeding in the first year of life is considered an excellent protection against future increases in serum lipid levels and in deaths caused by CAD. It is common knowledge that breastfeeding is related to the protection of children against certain infections during childhood. Obesity is more frequent during the first years of life, and is associated with early weaning and diffusion of incorrect nutritional patterns, which encourage overfeeding and even award obese babies with prizes.

Conclusions

The discovery that cardiovascular diseases may originate in childhood requires that risk factors be widely investigated during this period, with the aim of designing earlier and possibly more effective interventions, reducing morbidity and mortality in adult life. The strategies destined for the prevention of risk factors for a given disease are called Primordial Prevention, which differs from Primary Prevention (prevention of the disease itself). Healthy eating habits in childhood and adolescence provide better health, adequate intellectual growth and development, prevent immediate health problems, such as iron-deficiency anemia, obesity, nutritional disorders, and tooth decays. In addition, they can prevent health problems in the long run, such as coronary heart disease, cancer, and cerebral vascular accident.

The increasing concern with this matter can be observed in the creation of educational programs, involving mass communication media. In April 1998, in Rio de Janeiro, a Consensus Report of the InterAmerican Heart Foundation was elaborated for cardiovascular health of children and adolescents, based on the Canadian Consensus Report modified in October 1997. According to this report, “cardiovascular and cerebrovascular diseases are the major causes of death that are highly avoidable in adults older than 30 years in the American continent. Cardiovascular health depends on a combination of behaviors and healthy activities, suggesting that the approach to cardiovascular health should be holistic and should start in childhood.”

One of the aims listed in the Report is to prevent cardiovascular and cerebrovascular diseases by means of specific strategies targeted on nutrition, physical activity and smoking. Schools should function as a means to reach children, families and community.

The study of these matters is extremely important in our country, since the available literature on the actual importance of these risk factors in children from developing countries is scarce. Currently, there is a transition of the morbidity and mortality profile, with reduced incidence of infectious and parasitic diseases and an increase in the prevalence of risk factors for ischemic diseases in adult life, such as childhood obesity and sedentary behavior. The impact of this transition should be especially important in developing countries, which have limited health resources. It is extremely necessary that primordial prevention be established in order to avoid an increase in the incidence of ischemic heart disease with endemic nature in the future.

References


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