Review by William T. Couldwell, M.D.

Cardiorespiratory fitness and the progression of carotid atherosclerosis in middle-aged men. **Ann Intern Med** 134:12–20, 2001

Abstract:

Background: Good cardiorespiratory fitness has been associated with reduced risk for clinical events of atherosclerotic vascular diseases, but whether it is related to slower progression of early atherosclerosis is unclear. **Objective:** To study the association between cardiorespiratory fitness and the progression of early carotid atherosclerosis. **Design:** 4-year follow-up study. **Setting:** Eastern Finland. **Participants:** Population-based sample of 854 men 42 to 60 years of age. **Measurements:** Maximal oxygen uptake (VO_2max [L/kg per minute]) was measured directly by using respiratory gas exchange in a cycle ergometer exercise test. Carotid atherosclerosis was assessed by using B-mode ultrasonography. **Results:** After adjustments for age, technical covariates, and cigarette smoking, VO_2max had strong, inverse, and graded associations with 4-year increases in maximal intima-media thickness (IMT) (standard regression coefficient $\beta = 0.120$; $P = 0.002$); plaque height ($\beta = 0.140$; $P < 0.001$), surface roughness, and mean IMT ($\beta = 0.080$; $P = 0.035$). These associations weakened but remained statistically significant after additional adjustment for systole blood pressure, serum levels of apolipoprotein B, diabetes, and plasma fibrinogen levels. The increases in maximal IMT, surface roughness, and mean IMT (23%, 32% and 100%, respectively) were larger among men in the lowest quartile of VO_2max (< 26.1 mL/kg per minute) than among those in the highest quartile (> 36.2 mL/kg per minute). **Conclusions:** Good cardiorespiratory fitness is associated with slower progression of early atherosclerosis in middle-aged men. These findings are important because they emphasize that middle-aged men can be evaluated for cardiorespiratory fitness to estimate their future risk for atherosclerotic vascular disease. Additional research is warranted to investigate a possible causal relationship between cardiorespiratory fitness and atherosclerosis.

Comment:

There is increasing evidence that physical inactivity and poor cardiorespiratory fitness are risk factors for atherosclerotic vascular diseases.⁵ Such phenomena as hypertension, cigarette smoking, and hypercholesterolemia have become identified as a modifiable risk factors. Atherosclerosis develops from an asymptomatic phase to overt disease over decades. In the present study, the authors have performed a population-based study of middle-aged Finnish men, evaluating cardiorespiratory fitness by directly measuring maximal oxygen uptake (VO_2max) and by administering a questionnaire to assess physical activity. Asymptomatic atherosclerosis in the common carotid arteries (CCAs) was assessed over a 4-year period by using high-resolution B-mode ultrasonography. The authors noted an inverse association between the VO_2max and all baseline indicators of CCA atherosclerosis (maximal and mean intima-media thickness, plaque height, and surface roughness), after adjusting for other atherosclerotic risk factors, including cardiovascular, pulmonary and metabolic diseases. There are no previous reports concerning the association between cardiorespiratory fitness and the risk for stroke as there are for cardiac disease.^{3,4} Analysis of their data demonstrates that good cardiorespiratory fitness, as indicated by higher levels of VO_2max , is associated with slower progression of early CCA atherosclerosis in their study group. How much exercise is necessary to increase VO_2max ? Genetic factors definitely play a role (the same training program may increase VO_2max significantly in some individuals but little in others); however, the same authors have shown that VO_2max has only a modest association with the amount of physical

activity but a much stronger association with mean intensity of activity.² Thus, it is probable that only greater amounts of exercise intensive enough to improve fitness will slow atherogenesis. Furthermore, the results of other studies suggest that health habits other than physical activity may affect VO_2max . Both dietary restriction and aerobic exercise have been shown to increase VO_2max in obese men and women, with the combination of the two factors increasing VO_2max greater than either factor alone.¹ Together, these observations provide a basis for counsel of our male patients (and ourselves!) regarding asymptomatic CCA disease.

References

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