Body Mass and Weight as Indicators for Cholesterol Screening

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Background. Universal screening of serum cholesterol levels in adults has been recommended but not achieved. We were interested in factors that affected screening rates, and whether obese patients were more likely to have elevated cholesterol levels than other patients in our practice.
Methods. A sequential sample of charts was reviewed for height, weight, race, sex, diagnosis of hypertension or diabetes, and evidence of cholesterol screening.
Results. Of 604 adult patients, 32% had serum cholesterol measurements. No correlation was found between weight or body mass index and cholesterol levels. Patients with hypertension or diabetes were more frequently screened. Sex and race did not influence screening rates.
Conclusions. In this population neither weight nor body mass index was associated with elevated serum cholesterol levels, suggesting that screening must be offered without regard to level of obesity in order to find those patients who will benefit from intervention.
Key words. Cholesterol, serum; body weight; mass screening; family practice.
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Elevated serum cholesterol is a potentially treatable factor influencing the formation of coronary artery lesions involved in cardiovascular morbidity and mortality.[1,2] Universal screening has been recommended for adults,[3–5] with the possible exception of the elderly.[6,7]

Expressions of surprise by both staff and students when an obese patient was found to have a low or normal cholesterol level caused us to wonder whether there was any correlation between body weight, or obesity, and total cholesterol levels in our patient population, and whether obesity was influencing the decision to offer the patient cholesterol screening.

An association of cholesterol levels with weight or body mass index (weight/height^2) has been reported,[8,9] but differences in age,[10] sex,[11] race,[12,13] ethnic group, and socioeconomic status[14,15] may change this association.

In the face of all these factors, this retrospective study was undertaken to answer the following questions: (1) In the mixed population seen in an urban primary care practice, does obesity suggest a greater likelihood of elevated cholesterol levels? and (2) Does body habitus influence which patients are screened for cholesterol, and if so, is this appropriate?

Methods

The study took place at the Family Care Center in urban Buffalo, NY, in 1991. This group practice, staffed by six family practitioners, two general internists, and four nurse practitioners, cares for patients of all ages representing a variety of socioeconomic groups.

A sequential sample was selected by reviewing every fifth chart in an alphabetical file. Patients under the age of 18 years were excluded from the study. Setting alpha at .05 (two-tailed) and beta at .1, a sample size of 202 would be required to demonstrate a correlation of >.25.[16] The study size was based on an estimated one third of the patients having cholesterol data available.

A medical student (G.S.) used a standardized form to record patient age, height, weight at most recent visit, race, sex, and whether the patient was a smoker or had a diagnosis of hypertension or diabetes. Laboratory reports in the charts were reviewed for evidence of whether the patient had had cholesterol screening within the preceding year. Ten percent of the charts were randomly selected for a second review to verify accuracy of the reviewer's data.

Data analysis was done using the SPSS-X-PC+ soft-

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Table 1. Description of Study Population and Comparison of Rates of Cholesterol Screening in Subgroups

	Patients in Study (%)	Patients Screened for Cholesterol, %
Total group	604 (100)	32
Sex		
Men	226 (37)	32
Women	378 (63)	31
Race/ethnic group		
Black	295 (49)	31
White	222 (37)	35
Asian	12 (2)	—*
Hispanic	11 (2)	—*
Unspecified	64 (10)	
Current smokers	169 (28)	36
Hypertensive	123 (20)	52
Diabetic	42 (7)	57

**Number of patients in these groups is too small to make meaningful comparison.*

ware program. In the group of patients who had cholesterol screening, correlations were evaluated between weight and total cholesterol. Patients who had heights recorded were analyzed further by body mass index (BMI) measured in kg/m^2. Analysis of variance was used to determine effect of BMI on cholesterol levels. Chi-square analysis with Yates' continuity correction was used to compare the frequency of cholesterol screening in patients by quartile of body mass index.

Results

Charts of 604 patients were reviewed. Demographics of the study population are shown in Table 1, and were consistent with the demographics of the practice. Patients ranged in age from 18 to 76 years, with a mean of 40 years (±16). Cholesterol screening was done in 196 patients (32%). Total cholesterol levels ranged from 98 to 338 mg/dL (2.5 to 8.8 mmol/L), with a mean of 198 ± 47 mg/dL (5.1 ± 1.2 mmol/L). Of the group screened, 55% had cholesterol levels of ≤200 mg/dL (5.2 mmol/L), 28% were between 200 and 240 mg/dL (5.2 and 6.24 mmol/L), and 17% over 240 mg/dL (6.24 mmol/L).

A negative correlation was found between weight and cholesterol levels, but it did not reach statistical significance ($r = -.0748$) in the total group screened or in male and female subgroups.

Chi-square analysis showed no statistically significant difference in the rate of screening by sex or by race (black or white). Other ethnic/racial groups were too small for meaningful comparison.

Table 2. Rates of Cholesterol Screening by Body Mass Index Quartile

	Percent Screened		
BMI Quartile	Men	Women	Total
1 (lowest BMI)	35	35	35
2	34	51	43
3	49	55	51
4 (highest BMI)	40	36	37

Differences are not significant by chi-square analysis.
BMI denotes body mass index.

Heights were recorded in the charts of 114 men and 187 women. For these patients, BMI, calculated in kg/m^2, ranged from 15 to 53 with a mean of 27 ± 7. In those patients who were screened, regression analysis showed no correlation between recorded cholesterol levels and BMI ($R^2 = .09$). Table 2 shows the percentages of patients screened by BMI quartile. These differences did not reach statistical significance by chi-square analysis, but do suggest a trend toward less screening of those patients in the lightest quartile compared with heavier patients.

Discussion

In a review of data from the First National Health and Nutrition Examination survey (NHANES I), ambulatory adults' total cholesterol levels were directly associated with weight, body fat, and lean body mass.[8] Among men who reported to an atherosclerosis risk-factor detection clinic, those under 45 years old who were overweight had a significantly higher prevalence of elevated total cholesterol levels than men who were of normal weight in the same age group.[10] This difference did not persist in men over the age of 45 years. In young men, a change in body mass appeared to be a significant determinant of changes in serum total cholesterol.[17] A Dutch study found BMI positively associated with total serum cholesterol in older men but not in women.[11] Association of elevated cholesterol with time since last menses in perimenopausal women suggests that differences in cholesterol levels may be influenced by levels of endogenous estrogens.[18]

The population seen in an urban family care center includes a wide variety of patients, differing in age, race, sex, and socioeconomic status. Since many of these factors are related to differences in cholesterol levels, this may partially explain the lack of correlation between serum cholesterol and weight or BMI, which differs from

previous reports. No correlation was found between weight or BMI and cholesterol levels, indicating that the presence or absence of obesity is not useful for determining which patients should be offered cholesterol screening in this population. Many patients with high cholesterol will be missed if screening is concentrated on patients who are of average weight or overweight.

The prevalence of elevated cholesterol, over 240 mg/dL (6.24 mmol/L), was lower in this population than previously reported,[19] as were the mean cholesterol levels,[20] but these numbers must be viewed with caution, as only 32% of the total group was screened, and in this retrospective study, factors used to select this population are not evident. Race and sex did not seem to play a part in determining who was screened.

The practice studied was only 2 years old, and this may have contributed to the low rate of documentation of cholesterol levels, since patients may have had previous screening elsewhere, and testing may not need to be repeated in persons who previously had normal levels.[21] A number of recent studies have addressed factors that influence delivery of preventive care and screening[22–24] and methods to increase physician compliance with preventive care guidelines.[25,26] No interventions had been used in the practice at the time of this study.

Conclusions

Screening for hyperlipidemia by total serum cholesterol testing is recommended for all adults, and is particularly important for patients with cardiovascular risk factors. In this study, neither weight nor body mass index proved to be useful as a screening indicator for patients at risk for elevated serum cholesterol levels, suggesting that screening must be offered without regard to the level of obesity to find all patients who may benefit from the cholesterol-lowering interventions that are available.

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