Low Rate of Treatment of Hypercholesterolemia by Cardiologists in Patients With Suspected and Proven Coronary Artery Disease

Michael V. Cohen, MD; Mary-Jo Byrne, PA; Barbara Levine, PA; Ted Gutowski, MD; and Richard Adelson, MD

Background. Although specific guidelines for the treatment of hypercholesterolemia have been published, it is not known whether physicians treating patients likely to have lipid disorders have adopted the recommendations.

Methods and Results. The approach of cardiologists to the treatment of hypercholesterolemia in a metropolitan teaching hospital was assessed by interviewing patients with chest pain who were admitted for coronary angiography in 1988–1989 and by measuring fasting blood lipid profiles. At 1 month and again 12–24 months later, patients were contacted by telephone to determine if there had been any changes in treatment. Of 95 patients evaluated, 81 had coronary artery disease. Only 17% of those with high levels of total cholesterol and/or low density lipoprotein cholesterol were being actively treated with diet and/or drugs. In the remaining patients, either lipid studies had not been done or abnormal results had not been addressed. There was little change in treatment approach during the month after the diagnostic procedure. Furthermore, the experience was similar in those patients subjected to coronary revascularization. One to 2 years after the initial intervention, 69 of the original study group could be contacted again. Although active dietary or pharmacological therapy was initiated in some individuals during this interval, it was stopped in others. Thirty-five percent of hypercholesterolemic patients were receiving targeted therapy.

Conclusions. Thus, only a small proportion of patients with documented coronary artery disease and hypercholesterolemia were being actively treated for their lipid disorder, suggesting that the published treatment guidelines have not yet been fully accepted. However, an encouraging improvement in frequency of treatment of hypercholesterolemia was documented during the 1–2-year observation period. (Circulation 1991;83:1294–1304)

Intensive efforts have been made to identify risk factors for atherosclerosis in hopes that the disease itself could be prevented or at least attenuated. Genetic,1 experimental,2,3 epidemiological,4–19 and interventional20–32 studies have established that an elevated blood cholesterol level is a major cause of peripheral vascular and coronary artery disease and that lowering of elevated levels will result in a reduction of the risk of myocardial infarction and death related to cardiovascular disease. These conclusions were echoed in the strong recommendation of two National Institutes of Health (NIH) panels that blood cholesterol levels of the American population must be lowered,33,34 and aggressive treatment guidelines were outlined.34 Furthermore, educational campaigns were initiated to instruct the populace as well as physicians.35

Despite the existing data linking serum cholesterol levels and cardiovascular morbidity and mortality, the documented approaches of many physicians, whether old36–41 or young,36–43 medical school faculty37,39,41,44–46 or private practitioners,36,38,40,42,43,47–53 to hypercholesterolemia in their patients have often fallen short of the recommendations of the NIH panel.34 If attempts to lower the cholesterol level of the populace are to succeed, family practice doctors and general practitioners will have to become part of the solution. However, practices are difficult to

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Received December 5, 1989; revision accepted November 20, 1990.
change. Therefore, it would be advantageous to have one specialty group that might spearhead the campaign. The demonstration of one group’s acceptance of the campaign’s principles and aggressive treatment might encourage others to follow. Cardiologists would be a likely selection. They are called on daily to deal with the ravages of coronary artery disease, and they have been bombarded with the cholesterol doctrine for longer periods than others. It would seem reasonable to expect cardiologists to be in the forefront of the professional community seeking to promote such preventive medicine measures aimed at diminishing the prevalence of coronary artery disease. To evaluate the current position of cardiologists, their approach to screening for and treatment of blood lipid abnormalities at a major teaching hospital in a large metropolitan area was studied.

Methods

To determine the prevailing treatment of lipid disorders by cardiologists admitting patients to Montefiore Medical Center, an 800-bed tertiary care facility in New York City, patients were selected from those referred from March 1988 to March 1989 for elective coronary angiography for the evaluation of chest pain. No patient had been hospitalized during the 2 months preceding the procedure, and all were free of other systemic illnesses causing fluctuations in weight, changes in dietary intake, alteration of sense of well-being, or debilitation. Attempts were made to include all patients meeting these criteria in the evaluation, but some were missed because of the limitations imposed by the work schedules of the investigators. Therefore, 95 of 138 individuals meeting the entry criteria were actually included in the study. However, demographic and cardiac catheterization data in the 43 patients not enrolled were not different from those of the 95 subjects entered in the study. All patients were interviewed on admission to determine their awareness of prior risk factor evaluation and of the nature of any interventions or therapy initiated by their cardiologist or other medical personnel. A standardized questionnaire was used basically to determine whether the patient had hypertension or diabetes, whether the serum cholesterol level was known, and what the referring physician had said about any lipid abnormality or possible therapy. Emphasis was placed on eliciting a history of treatment of blood lipid abnormalities. On the basis of this interview, patients were placed into one of five groups. Group 1 patients were unaware that any testing of blood lipids had ever been done. Group 2 patients claimed that their doctors had said that their blood tests were normal. Subjects in group 3 were aware of an abnormality of blood lipids but were given only some vague advice by their physicians. In these instances, the physician was likely to have merely suggested that the patient adopt a low cholesterol diet without offering any specific guidelines or advice about how to achieve this goal. Patients in group 4 had been counseled and given detailed literature on diets by the physician or had been referred to a dietitian to help correct the lipid problem. Finally, patients in group 5 had been started on pharmacological therapy. Therefore, only in groups 4 and 5 had the physician actively intervened to correct a documented blood lipid abnormality.

Patients in all groups were fasted the night before angiography. After transport of patients to the cardiac catheterization laboratory but before insertion of catheters or administration of any drugs including heparin, 10 ml blood was collected for measurement of serum total cholesterol, high density lipoprotein (HDL) cholesterol, and triglyceride levels by the hospital chemistry lab. Serum cholesterol values were always posted in the patient’s chart within 24 hours. The other results were available within 2–3 days and were then inserted into the chart or were accessible by computer terminal if the patient had been discharged. At the time of discharge, all charts were reviewed to determine whether the referring physician had made note of any abnormal blood lipid determinations and whether any therapeutic measures had been contemplated. Also, all diet orders were reviewed. One month after the diagnostic catheterization procedure, all patients were contacted by telephone to determine whether there had been any change in treatment of possible lipid abnormalities. An interview format similar to that used during the initial contact was used. Again, 12–24 months after the initial cardiac catheterization, attempts were made to contact all patients to determine whether their knowledge of their condition had changed and whether any additional interventions had been initiated. Particular attention was paid to a review of all pharmacological agents being taken.

Total cholesterol was measured enzymatically by an automated analyzer.54 The HDL cholesterol fraction was similarly measured enzymatically after precipitation of other lipoproteins by buffered phosphotungstic acid-β-hydrate.55 The serum triglyceride level was determined enzymatically by a clinical analyzer after treatment of the sample with lipase.56 The resulting glycerol was exposed to glycerol dehydrogenase, and the amount of reduced NADH was measured spectrophotometrically.57 The level of low density lipoprotein (LDL) cholesterol was calculated as the difference between the level of total cholesterol and the sum of HDL cholesterol and one fifth of the triglyceride level. In only one patient with normal coronary arteries did the triglyceride level exceed 400 mg%. In this individual, the LDL cholesterol level was not calculated because of failure of the assumptions when the triglyceride concentration exceeds this level. The reproducibility of serum lipid determinations is constantly being evaluated by stringent quality control measures and testing of duplicate samples. The accuracy of lipid determinations in the hospital laboratory has been confirmed by the excellent results obtained in interlaboratory proficiency testing performed by the College of American Pathologists and the New York City Department of
TABLE 1. Blood Lipids and Extent coronary artery disease in Patient Groups and Those With Coronary Revascularization

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Age (yrs)</th>
<th>Number of diseased coronary arteries</th>
<th>Chol (mg%)</th>
<th>TG (mg%)</th>
<th>HDL chol (mg%)</th>
<th>LDL chol (mg%)</th>
<th>Total chol</th>
<th>HDL chol</th>
<th>LDL chol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>61.4±2.2</td>
<td>2.1±0.2</td>
<td>242.4±15.3</td>
<td>154.0±13.2</td>
<td>44.9±1.8</td>
<td>168.9±14.7</td>
<td>6.65±0.48</td>
<td>3.90±0.42</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>62.0±2.4</td>
<td>2.1±0.2</td>
<td>218.4±7.8</td>
<td>172.7±13.1</td>
<td>45.6±2.8</td>
<td>138.6±8.0</td>
<td>5.11±0.30</td>
<td>3.28±0.25</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>21</td>
<td>58.3±2.5</td>
<td>2.3±0.2</td>
<td>254.6±9.5</td>
<td>206.5±18.7</td>
<td>45.2±3.9</td>
<td>172.3±10.6</td>
<td>6.38±0.51</td>
<td>4.33±0.43</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>59.5±4.1</td>
<td>1.8±0.5</td>
<td>240.2±10.0</td>
<td>147.8±19.3</td>
<td>49.0±11.0</td>
<td>161.8±2.0</td>
<td>5.44±0.84</td>
<td>3.74±0.68</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>54.5±2.5</td>
<td>2.5±0.3</td>
<td>213.6±11.1</td>
<td>180.2±34.4</td>
<td>39.7±2.3</td>
<td>137.8±11.6</td>
<td>5.58±0.47</td>
<td>3.61±0.42</td>
<td></td>
</tr>
<tr>
<td>CABG+PTCA</td>
<td>40</td>
<td>59.5±1.7</td>
<td>2.2±0.1</td>
<td>222.4±6.3</td>
<td>173.9±12.0</td>
<td>46.2±2.2</td>
<td>142.8±5.9</td>
<td>5.06±0.24</td>
<td>3.29±0.19</td>
<td></td>
</tr>
</tbody>
</table>

Values are mean±SEM. Chol, cholesterol; TG, triglycerides; HDL, high density lipoprotein; LDL, low density lipoprotein; CABG, coronary artery bypass grafting; PTCA, percutaneous transluminal coronary angioplasty.

Health and by standardization of results with reference samples obtained from the Centers for Disease Control. The coefficient of variation for cholesterol determination in the hospital laboratory is 0.9%.

Data are presented as mean±SEM. Statistical significance of group differences was determined by Student’s t test.58 Values of p<0.05 were considered to be significant.

Results

Of 95 patients entered into the study, 58.6% had been referred to the admitting cardiologist for the express purpose of evaluation for coronary angiography, whereas 41.4% had been followed up and treated by the cardiologist for varying time periods before cardiac catheterization. Of the total group, 19% were admitted by four full-time faculty members, 8% by cardiology fellows, and the remaining 73% by 12 cardiology groups or practicing cardiologists. Of the 12 private cardiology groups or individuals, five admitted at least eight patients during the year of observation. One subject died 2 weeks after cardiac catheterization and is not considered further. Because of the potential problem of laboratory error in the measurement of serum lipid levels, a comparison was made between the cholesterol level measured in the blood obtained in the cardiac catheterization laboratory and a random cholesterol level determined as part of the routine admission blood chemistry screening in the patients. There was remarkable agreement between the two values; the average difference was only 3.6% (range, 1.1–7.5%).

Thirteen individuals had normal coronary arteries, and four of these had total cholesterol levels that exceeded 240 mg%. The remaining 81 subjects had obstructive coronary artery disease with at least a 50% luminal narrowing of one coronary artery. Table 1 summarizes data for this group with obstructed vessels. The average age of patients in each of the five groups ranged from 54.5 to 62.0 years. There were 21 women and 60 men. Most groups had an average of two obstructed coronary arteries. Only in group 5 patients on drug therapy were there a tendency for more widespread involvement. Serum total cholesterol ranged from 144 to 503 mg%, and LDL cholesterol ranged from 64 to 401 mg% at the time of initial testing. In group 1 patients without knowledge of prior testing, serum cholesterol averaged 242 mg%.

In patients who were told that their blood lipids were normal (group 2), average serum cholesterol was 218 mg%, although nine of the 24 patients in this group had serum cholesterol levels in excess of 240 mg%. The average serum cholesterol in patients who were told that there was an abnormality but in whom little was done (group 3) was 255 mg%. In patients on a prescribed diet (group 4), the serum cholesterol averaged 240 mg%, whereas it was 214 mg% in those on targeted drug therapy (group 5). Serum LDL cholesterol data showed a similar pattern, whereas serum HDL cholesterol levels varied little among groups.

The threshold for treatment of blood lipid abnormalities continues to evolve. Figure 1 depicts the number of individuals in the study population having serum cholesterol levels at the time of cardiac catheterization within a given 20 mg% range. If a cholesterol level of 240 mg% is selected as the threshold for treatment, then 30 individuals had an abnormally high level, but only three (10.0%) were in groups 4 and 5 (cross-hatched bars) and, therefore, receiving aggressive intervention by the referring cardiologist. There was no difference whether the patient had a long-term relationship with the cardiologist or was a recent referral. If, on the other hand, the threshold level is

![Figure 1](http://circ.ahajournals.org/)

**FIGURE 1.** Bar graph showing distribution of serum total cholesterol (Chol) levels in 20 mg% steps at the time of cardiac catheterization in 81 subjects with proven coronary artery disease. Open bars represent subjects in nontreatment groups 1–3; cross-hatching represents individuals in active treatment groups 4 and 5.
FIGURE 2. Bar graph showing distribution of serum low density lipoprotein cholesterol (LDL-Chol) in 20-mg% steps at the time of cardiac catheterization in 81 subjects with proven coronary artery disease. Open bars represent subjects in nontreatment groups 1–3; cross-hatching represents individuals in the active treatment groups 4 and 5.

considered to be 200 mg% as suggested by the National Cholesterol Education Program, then 60 individuals had abnormally elevated cholesterol levels, but only nine patients (15.0%) were in groups 4 or 5.

LDL cholesterol data are presented in Figure 2. If the threshold level is considered to be 160 mg%, then only 18.8% of the 32 individuals with elevated levels were being treated with diet and/or drugs. With a threshold level of 130 mg%, cardiologists were actively treating only 14.0% of 57 with high levels. Of particular note is the absence of treatment of the patient with an LDL cholesterol level of 401 mg% and a total cholesterol level of 503 mg%.

To determine whether results of the cardiac catheterization and documentation of significant coronary artery obstructive lesions would alter the approach of the referring cardiologists to treatment of the lipid disorders, regimens before and after the catheterization were compared. Figure 3 demonstrates that at the time of cardiac catheterization 17.3% of the subjects with proven coronary disease were in groups 4 and 5. One month later, there was a small improvement, when 25.9% of the study group were being actively treated. There was very little movement between groups. In Figure 4, the boxes on the left of each panel represent patient groupings at the time of cardiac catheterization; those on the right are the groupings 1 month later. For the more liberal treatment threshold levels of 240 mg% for cholesterol and 160 mg% for LDL cholesterol (Figure 4, left panel), only 16.7% of the 36 patients with abnormally high blood lipids (solid lines) and, therefore, in need of dietary and/or drug intervention were being treated at the time of the cardiac catheterization. One month later, there was little evidence that patients with abnormal lipids had moved between nontreatment (1–3) and treatment (4,5) groups. Although four patients with abnormally elevated blood lipids did go from one of the three nontreatment groups to either group 4 or 5, one patient with a documented high blood level of LDL cholesterol was removed from the active treatment groups. Similarly, with more restrictive treatment threshold levels of 200 mg% for total cholesterol and 130 mg% for LDL cholesterol (i.e., those recommended by the National Cholesterol Education Program), only 11 of 61 (18.0%) of those needing treatment were receiving it at the time of the cardiac catheterization (Figure 4, right panel). Again, 4 weeks later, there were only eight additional patients who received treatment; one patient was moved from a treatment group to one of the nontreatment groups.

Because of the possibility that the patients’ recollections of events occurring 1 month earlier during a hospitalization might be unclear, all charts were reviewed for possible indications of intended therapy of lipid abnormalities. Despite the posting of abnormal blood cholesterol results in all patient charts within 24 hours of admission, infrequently were results commented on in the progress notes, and rarely were treatment plans apparent. Furthermore, a consultation for nutritional instruction was never found.

FIGURE 3. Pie graphs showing subgrouping of 81 subjects with proven coronary artery disease before and 1 month after cardiac catheterization. Of note is the small change (from 17.3% to 25.9%) in the proportion of individuals in active treatment groups 4 and 5 despite documentation of coronary obstructive disease in all and coronary revascularization procedures in half of the study population. Groups 1–3, nontreatment groups.
To investigate whether approaches to treatment of lipid abnormalities might be different in individuals undergoing revascularization by either coronary artery bypass grafting or percutaneous transluminal coronary angioplasty, these patients were analyzed separately. As shown in Table 1, there were 40 such subjects, 20 undergoing angioplasty and 20 having surgery. At the time of cardiac catheterization, serum lipid levels in these individuals destined to have coronary revascularization were similar to those noted in the larger group. Despite undergoing interventions to restore coronary arterial flow, patients in this subgroup were not treated more aggressively to retard progression of the atherosclerotic process. For the higher threshold values for total cholesterol and LDL cholesterol (Figure 5, left panel) or for the more restrictive threshold levels (Figure 5, right panel), there was very little transfer between groups, and treatment with diet or drugs was recommended in only 18–30% of the individuals with abnormal lipid profiles.

Because a 1-month interval might not have represented sufficient time for the attending physician to formulate a comprehensive treatment plan, an attempt was made to contact all patients again in early 1990, 12–24 months after the initial cardiac catheterization. At this time, nine patients could not be contacted, and their physicians had no knowledge of their recent status. Three other subjects had died during the interval. Thus, 69 individuals were available for further evaluation. Almost all patients were aware that their serum cholesterol levels had been checked, but regardless of the values documented at the time of the cardiac catheterization and independent of any targeted therapy, all claimed that their doctor had said that their serum cholesterol was acceptable. In the 1–2 years

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**Figure 4.** Left panel: Changes from the time of cardiac catheterization (pre-cath) to follow-up at 1 month (1 mo p cath) of the number of patients in each of the five patient groups. Numbers within boxes represent the number of subjects in each group. Open boxes represent nontreatment groups; cross-hatched boxes represent active treatment groups. Solid lines represent subjects with serum total cholesterol (total chol) levels greater than 240 mg% or low density lipoprotein cholesterol (LDL-chol) levels greater than 160 mg%; dashed lines represent patients with total chol levels of 240 mg% or less and LDL-chol levels of 160 mg% or less. The small numbers represent the number of patients passing from any group to the same or another group after 1 month. Thus, during the 1-month interval, eight additional patients, four with normal and four with abnormal serum lipid levels, moved from one of the first three nontreatment groups to either group 4 (dietary intervention) or 5 (pharmacological therapy). One patient with abnormal blood lipids moved from group 4 to group 3. Twenty-six other patients with apparently normal blood lipids at the time of cardiac catheterization were still untreated at the 1-month follow-up. Right panel: Changes from the time of cardiac catheterization to follow-up at 1 month of the number of patients in each of the five patient groups. Format is similar to that described in left panel. Solid lines represent patients with total chol levels greater than 200 mg% or LDL-chol levels greater than 130 mg%; dashed lines represent subjects with total chol levels of 200 mg% or less and LDL-chol levels of 130 mg% or less. With these more restrictive threshold treatment levels, 43 patients with abnormal blood lipid levels were not receiving targeted therapy at the time of follow-up 1 month after their cardiac catheterization.
since the first telephone contact, one additional patient had been referred to a dietician for dietary counseling, and six patients had been started on pharmacological agents. Of these, three patients had total serum cholesterol levels above 260 mg%, whereas in the remaining three, serum cholesterol had ranged from 215–240 mg%. During the same interval, drug therapy was discontinued in five individuals. These subjects were unaware of any specific reasons and claimed that they had not complained of any particular side effect. Of the five subjects, serum cholesterol levels on treatment at the time of the cardiac catheterization were between 190 and 200 mg% in three and 226 and 266 mg% in the other two. If one assumes that the cholesterol level did not rise in these five individuals after discontinuation of drug therapy, then only 35.5% of the individuals with either a total cholesterol exceeding 240 mg% or LDL cholesterol exceeding 160 mg% were being actively treated with either diet or drugs at the time of the second follow-up. For the more restrictive levels of 200 mg% for total cholesterol and 130 mg% for LDL cholesterol, 32.8% of those with abnormal lipids were receiving active treatment after 1–2 years.

During the 1–2-year interval after the initial telephone contact, two additional individuals had coronary angioplasty, and two had surgical revascularization. One individual in each category was being treated with lipid-lowering drugs by the time of the
second telephone contact. However, one individual was not being treated after angioplasty, and one was not being treated after surgical revascularization (serum cholesterol, 273 and 268 mg%, respectively).

**Discussion**

The effects of an elevated serum cholesterol level on vascular disease have been debated for many decades. Attempts by a few to publicize the merits of lowering blood lipid levels of Americans have been met with some success. In the past 25 years, serum cholesterol levels in the population have actually declined by 6–15 mg%, perhaps contributing to the welcome diminution in the annual mortality rate for cardiovascular disease.59–62

Because lowering of serum cholesterol by either dietary or pharmacological measures has resulted in concomitant falls in occurrence rates of nonfatal myocardial infarctions and death attributed to cardiovascular causes,63,64 an NIH Expert Panel established an aggressive treatment protocol in an attempt to substantially lower the serum cholesterol level of the American population34 and embarked on an education campaign to alert both the public and the medical community to the benefits of evaluation of blood cholesterol status and treatment of levels above cited threshold values.35 Random surveys of the general public in 1983 before and again in 1986 after initiation of the public education campaign have revealed a surprisingly high baseline awareness of the importance of serum and dietary cholesterol, with further improvement after concerted attempts at publicization of the campaign.65 The attitude of the public is exemplified by the enthusiastic response to announcements for mass cholesterol-screening projects.48

With several notable exceptions,53,66,67 surveys of medical practitioners before and again after announcement of the NIH guidelines and initiation of the educational campaign have revealed a continuing uncertainty regarding serum cholesterol as an important risk factor for coronary artery disease.36,38,43,52 and a failure both to screen patients for blood lipid abnormalities32–44,52,66 and to treat high serum cholesterol levels.43,48,49,51 Hypercholesterolemia has been overlooked in hospitalized patients with both overt heart disease and clinically normal hearts37,41,44–46 and may be untreated when individuals identified as having high blood cholesterol levels during mass screenings present to their physicians.48–51 When treatment is initiated, the threshold levels of cholesterol are significantly higher38,40,53 than those recommended by the NIH panel.34

The approaches of practicing cardiologists admitting patients to a New York City hospital have been evaluated in the present study not with mailed questionnaires but with a prospective analysis of the adequacy of treatment of lipid disorders in their patients. The average age in the five patient groups ranged from 54.5 to 62.0 years (Table 1). Cohort and interventional studies have generally evaluated middle-aged individuals, often males,4–32 but data from the Framingham Study suggest that total cholesterol is linked to the risk of coronary heart disease in individuals as old as 88 years.17,69 Although there were patients older than 60 years and a few septuagenarians, 58.5% of the study subjects with elevated blood lipid levels were younger than 60 years, and 23.1% were younger than 50 years.

It is recognized that patients' recollections of lipid testing and of subsequent physician advice may have been inaccurate; therefore, it is possible that the composition of the first three patient groups may be misleading. Nonetheless, it is equally apparent that of the patients not in either group 4 or 5, 76.1% had total serum cholesterol levels exceeding 200 mg%, and 40.3% had levels greater than 240 mg%, confirming the presence of a large group of untreated hypercholesterolemic patients with coronary artery disease.

Only a few additional attempts were made to address the issue of possible abnormal blood lipids during the month after coronary angiography had confirmed the presence of coronary atherosclerosis, and individuals undergoing surgical revascularization or balloon angioplasty were not treated more aggressively. The decision to finally treat individuals with hypercholesterolemia was delayed until serum concentrations reached levels well above those suggested by the NIH Expert Panel.34 During this month, intensive dietary instruction or pharmacological therapy was prescribed for eight patients with serum cholesterol levels between 224 and 503 mg% and averaging 288.1±34.6 mg%. Four of the eight had cholesterol levels exceeding 250 mg%. Of note, many individuals with comparable blood cholesterol levels were untreated. Review of hospital charts failed to uncover recognition of or treatment plans for lipid disorders in patients claiming absence of intervention, and review of patient medications 1 month later did not reveal evidence of specific pharmacological treatment. It is not possible to know the pretreatment cholesterol values in the 14 individuals in groups 4 and 5 already being treated with diet and/or drugs before cardiac catheterization. However, in these two groups, serum cholesterol concentration continued to exceed 200 mg% in nine patients and was greater than 240 mg% in three despite targeted therapy.

Because the initial evaluation of the subjects selected for this study began only 2 months after publication of the complete guidelines of the NIH Expert Panel,34 it was considered possible that slow dissemination of the information might have explained the initial absence of aggressive treatment of hyperlipidemia. Therefore, attempts to contact all patients at least 1 and up to 2 years after their cardiac catheterization were made. Information could not be obtained for nine patients, two of whom were being treated pharmacologically at the time of the 1-month follow-up. It is striking that only 35% of the contacted patients with documented hyperlipidemia
were being actively treated with diet and/or drugs more than 2 years after publication of the NIH guidelines\(^3^4\) and at least 1 year after this study’s preliminary data obtained at cardiac catheterization and the 1-month follow-up were presented to the hospital’s attending cardiologists as well as interns. It is also noteworthy that even some hyperlipidemic individuals undergoing coronary revascularization were still not being treated.

Although only 40% of the study subjects undergoing coronary angiography were long-term patients of the admitting cardiologists, the rate of initial treatment of their patients by these specialists was no better than that of interns referring patients to them. There was little evidence of more aggressive treatment of the problem during the first month after documentation of coronary atherosclerosis or after coronary revascularization, times when the patient was clearly under the care of the cardiologist. Evidence that progression and regression of coronary artery atherosclerotic lesions\(^2^1,2^5,2^7,3^1,7^0,7^1\) occlusion of saphenous vein bypass grafts\(^7^2\) and restenosis of coronary arteries after successful angioplasty\(^7^3,7^4\) are all correlated with serum cholesterol levels further emphasizes the need for appropriate intervention in hyperlipidemic patients with evident disease and especially in those undergoing revascularization. Virtually all subjects had some continuing relationship even 1–2 years later with their admitting cardiologist, who, therefore, had recurring opportunities to address the problem.

There are several possible causes for the lack of more aggressive involvement of cardiologists and other medical personnel in the assessment and treatment of hyperlipidemias. At least one theoretical analysis\(^7^5\) of patients with presumed normal hearts has suggested that lowering of serum cholesterol may have little effect on life expectancy; another\(^7^6\) has indicated that lifelong pharmacological therapy might not be cost-effective. However, primary\(^7^7\) and secondary\(^7^8\) intervention trials have documented decreases in all-cause mortality. In one study in hospitalized patients, the most common excuse given by house officers for neglect of lipid disorders in their patients was lack of time.\(^4^1\) On the other hand, medical attending physicians most often claimed they were not responsible for the long-term care of the patients.\(^4^1\) Obviously, counseling of patients in an attempt to have them change their life-style is a time-consuming activity, and, realistically, there is no or little financial reimbursement for this type of intervention. Furthermore, physicians are not trained to advise patients on diet,\(^7^9\) one of the cornerstones of treatment of the individual with a high serum cholesterol, and, in general, are unsure how to counsel patients about lifestyle changes or believe their efforts to be ineffective.\(^5^8,4^2,5^2,5^3,7^9\) Many of those that do attempt counseling admit to speaking to their patients for less than 2 minutes regarding all health habits.\(^8^0\) Finally, many physicians are reluctant to delegate services to other health professionals, for example, dietitians.

To achieve more optimal treatment of hyperlipidemic disorders, a more intensive educational thrust is required.\(^1^8,5^2,6^4\) Physicians, including cardiologists, must be made to appreciate the benefits of low blood cholesterol levels. Physicians in Massachusetts\(^8^0\) and Richmond, Virginia,\(^7^9\) welcome continuing medical education programs as a vehicle for transfer of information; others value programs established by professional societies.\(^7^9\) The Minnesota Heart Health Program has been very successful in increasing the understanding of local medical personnel, encouraging their participation in treatment of their patients, and raising the consciousness of public health officials.\(^5^2\) Additional emphasis must be placed on this issue in medical school and house staff training programs.\(^8^2\) It is gratifying to realize that some of these educational efforts have indeed produced an increased awareness of the cholesterol problem. Thus, in Schucker’s report\(^3^8\) of physician surveys done in 1983 and again in 1986, there was a significant and encouraging decrease in threshold levels at which physicians would treat hypercholesterolemia. However, cardiologists were not much different from internists. The present data also suggest an encouraging trend. By the time of the second telephone contact, virtually all patients knew that their serum cholesterol had been tested. Furthermore, the proportion of patients with hyperlipidemia receiving specific treatment increased from 17% at the time of cardiac catheterization to 25% after 1 month to 35% 1–2 years later. However, the upward trend is only a modest one and underscores the need for intensive education for cardiologists as well as internists and family practitioners. Undoubtedly, in areas such as Framingham, Massachusetts, where epidemiological studies have been conducted, physicians are likely to be keener about treatment of hypercholesterolemia. But involvement of physicians probably quickly fades as their distance from these centers increases. However, even if all physicians believed in the merits of lowering serum cholesterol levels, the program cannot be successful unless some of the more mundane difficulties already noted are addressed. For example, the physician probably requires the assistance of a “prevention nurse,” counselor, or dietitian who has been suitably trained to discuss with patients lifestyle changes, including diet, and who can clarify and amplify the physician’s message, encourage the patient, provide necessary feedback, and follow his/her progress.\(^5^2,8^3–8^5\) Such a person clearly would find a ready niche in the cardiologist’s office and probably also in the office of the generalist, who undoubtedly sees many individuals with asymptomatic hyperlipidemia. Financial issues still remain to be resolved but should not prevent the medical community from instituting needed patient care.

Acknowledgment

We would like to thank Ms. Marlene Haynes for secretarial support.
References


**KEY WORDS** • atherosclerosis • cholesterol • hyperlipidemia • risk factors
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Circulation. 1991;83:1294-1304
doi: 10.1161/01.CIR.83.4.1294

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

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