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Guidelines for the Prevention of Symptomatic Cardiovascular Disease, Based upon the Presence of Coronary Artery Calcified Plaque—Provided by the Society for the Prevention of Symptomatic Heart Disease

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Abstract

Introduction: The epidemic of atherosclerotic cardiovascular disease in the Western World accounts for the majority of morbidity and mortality in adults. This disease is on the increase, and previous recommendations using "risk equations" to prescribe preventive treatment have not been successful in reducing the prevalence of cardiovascular disease. Furthermore, compliance with statin medication has been limited, with approximately 50% of individuals being non-compliant within five years. This situation is unacceptable since atherosclerosis is both preventable and reversible. **Methods:** The guidelines presented in this article utilize coronary artery calcium scanning as the basis for preventative therapeutic decisions and identifying the presence of asymptomatic cardiovascular disease. This radiographic technique is superior to "risk equations" in predicting future cardiovascular events. It provides a comprehensive assessment of the lifelong insults to the coronary artery vascular endothelium and the resulting inflammation. Coronary artery calcium scanning is widely available, inexpensive, safe, and reproducible. It has the major advantage of increasing treatment compliance in patients with positive coronary artery calcium scores. **Results:** All suggested guidelines are supported by published scientific data. Citations are provided to allow the reader to obtain further information. The authors are available for further consultation. Each guideline provides specific recommendations that the primary caregiver can discuss with the patient. Patient involvement in decision-making is strongly recommended. Both treatment costs and adverse effects are minimal. **Conclusion:** It is anticipated

that the early identification of asymptomatic cardiovascular disease and its aggressive treatment will result in regression of subclinical atherosclerosis. Adoption of these guidelines will stop the epidemic of symptomatic heart disease and result in healthier and more satisfied patients.

Keywords

Symptomatic Cardiovascular Disease, Coronary Artery Calcium Scan, Myocardial Infarction, Cardiovascular Risk, Atherosclerosis, Risk Equations

1. Purpose

The sole purpose of these guidelines is to eradicate the epidemic of cardiovascular disease in the United States in a cost-efficient, feasible manner [1]. The recommendations set forth in this set of guidelines were constructed by all five members of the Board of Directors for the non-profit organization—the Society for the Prevention of Symptomatic Heart Disease. The board members are all professional physicians with extensive experience with patient care. They consist of two endocrinologists, a pediatrician, a cardiologist, and an internist. They reviewed the pertinent literature, discussed each publication cited in the references, and contributed to each guideline. All guidelines are based on the published scientific literature, not on "expert opinion". They are described in a straightforward, readily achievable approach. Citations are provided for all important statements. No outside agencies or pharmaceutical companies were involved or contracted to draft or edit the recommended guidelines. No outside funding or support was obtained. No Board member has a conflict of interest relative to these guidelines.

2. Introduction

Atherosclerotic cardiovascular disease (ASCVD) is the number one cause of death in the United States and the Western World [2]. This mortality is greater than all cancers combined and twice the number of deaths from Covid-19. According to the American Heart Association, the cost of ASCVD to the American Public is 350 billion dollars/year [3]. This huge amount is expected to triple by 2030 [3] [4]. Furthermore, this disease often strikes individuals in the prime of their life, greatly reducing their productivity and ability to support and/or maintain a family.

ASCVD is both a preventable and reversible disease [5] [6] [7]. Published guidelines by other organizations have failed to reverse the increased mortality and morbidity of ASCVD. The failure to end this epidemic in the United States should be urgently corrected. In the last decade, great progress has been made in understanding the pathogenesis of ASCVD and its preventative treatment, which is both inexpensive and widely available [8]. Translation of these facts to reduce ASCVD requires a concerted effort by the government, social organizations, and

the medical/industrial complex. Barriers include political, financial, and personal interests. The non-profit organization, The Society for Prevention of Symptomatic Cardiovascular Disease, is publishing these ASCVD prevention guidelines with the expectation that the incidence and prevalence of ASCVD will be significantly reduced within the next five years.

Our approach, detailed in these guidelines, is to identify ASCVD in the asymptomatic individual by identifying plaques in the coronary arteries using the coronary artery calcium radiological procedure [9]. This approach differs from all other professional guidelines which are based on a one-time, calculated risk assessment from known ASCVD risk factors [10] [11]. The deficiencies of risk equations have been well documented [12] [13] [14]. The ultimate goal of our pathophysiologically-based guidelines is to save lives by preventing heart attacks and strokes (**Table 1**). Since ASCVD begins at birth and progresses throughout life [15] [16] [17], pre-symptomatic identification of ASCVD is essential if heart attacks and atherosclerotic strokes are to be prevented [18]. Because there is no risk factor analysis that will exclude ASCVD with high sensitivity and in all populations, liberal use of calcium scanning (whose high sensitivity is not population dependent) is essential [19]. This technique should be considered routine health maintenance in all individuals that have any major risk factors for ASCVD (including an LDL-cholesterol greater than 70 mg/dl) since an LDL-C of above 70 mg/dl is a significant risk factor [20]. Why has not coronary artery calcium scoring been recommended as the primary approach in all asymptomatic patients for identification and subsequent treatment of asymptomatic heart disease? The reason is the inertia of medical institutions to change their current procedures and policies. In fact, on average, it takes 17 years for a new and effective medical technique to be translated into improved patient care [21]. Support for our approach has been published [22] [23] [24].

3. Methods

The guidelines detailed below were formulated from the many published studies detailing the positive correlation between coronary artery calcium scoring and the presence of subclinical cardiovascular disease. Each guideline was thoroughly discussed, edited, and documented by the authors. An attempt was made to be concise, yet provide sufficient information to convince the reader as to the guidelines' scientific validity.

4. Results

The following 20 guidelines provide a complete approach to preventing cardiovascular disease in the clinical setting.

Guideline #1: *Perform a Coronary Artery Calcium* (*CAC*) *Scan on all adult individuals above the age of* 40 *who are not already diagnosed with ASCVD.*

CAC scanning is widely available throughout the United States. Every town with CT radiographic facilities has the potential to do CAC scoring. The cost is

modest (~$100) and may be reimbursable by medical insurance (according to individual state law, e.g. Texas and New Mexico). Individual insurance companies may reimburse the cost according to their policy. The billing code for a coronary artery calcium scan is 75571.

Table 1. Condensed guidelines.

Guideline #1: *Perform a Coronary Artery Calcium* (*CAC*) *Scan on all adult individuals above the age of* 40 *who are not already diagnosed with ASCVD.*

Guideline #2: *All patients with positive CAC scores* (>0) *should be treated to lower their LDL-C below* 50 *mg/dl.*

Guideline #3: *Ezetimibe* 10 *mg/day should always be ordered whenever also ordering a statin to lower LDL-C.*

Guideline #4: *Every asymptomatic diabetic patient should receive a CAC score before initiating statin therapy. Diabetes is not a coronary artery disease equivalent.*

Guideline #5: *It is not necessary to start medical therapy on anyone with a zero calcium scan unless his/her major risk factors are very significant.*

Guideline #6: *The lipid goal is to reduce LDL-cholesterol* (*LDL-C*) *to* 50 *mg/dl or less, therefore medically treat all patients with a positive CAC scan if LDL-C is above* 50 *mg/dl*

Guideline #7: *Start medical therapy with rosuvastatin* 10 *mg/d, ezetimibe* 10 *mg/d, and a low cholesterol diet* (*less than* 200 *mg of cholesterol/day*).

Guideline #8: *In patients who are "intolerant" of statins, start rosuvastatin slowly,* 5 *mg once per week, ezetimibe* 10 *mg/day, and a low cholesterol diet.*

Guideline #9: *If fasting triglycerides are elevated* (>150 *mg/dl but* <500 *mg/dl*), *correct secondary causes first, then initiate fenofibrate and statin therapy.*

Guideline #10: *Low dose aspirin* (82 *mg/day*) *is recommended for individuals with a CAC score* > 100. *Aspirin is not recommended for individuals* > 65 *years of age.*

Guideline #11: *To achieve an LDL-C below* 50 *mg/dl, a low cholesterol diet* (<200 *mg/day*) *is essential.*

Guideline #12: *Exercise is beneficial in many metabolic ways but it has a minimal effect on lowering LDL-C.*

Guideline #13: *For risk assessment, measure both fasting Lipoprotein*(*a*) *and high sensitivity C-reactive protein* (*hsCRP*), *and calculate non-HDL total cholesterol.*

Guideline #14: *If mild symptoms of stable angina occur* (*e.g. with exercise*), *increase aggressive medical therapy to lower all risk factors.*

Guideline #15: *Normalize the major risk factors for atherosclerosis including smoking, blood pressure, hyperglycemia, and triglycerides.*

Guideline #16: *A repeat CAC score is unnecessary for patients with known symptomatic atherosclerotic cardiovascular disease. It will almost always be positive.*

Guideline #17: *When statins are started in a patient with a positive coronary artery calcium scan, monitor the hemoglobin A1C which will tend to increase.*

Guideline #18: *A repeat CAC score in a patient with a positive score is unnecessary. Calcium in the wall of the artery almost never regresses.*

Guideline #19: P*atient involvement with CAC testing and treatment goals is necessary to achieve an LDL* < 50 *mg/dl.*

Guideline #20: *Expert consultation for difficult ASCVD clinical problems in asymptomatic individuals should be obtained.*

Because CAC scanning is noninvasive, very low risk, inexpensive, and requires only about 10 minutes, it is recommended for detection of asymptomatic coronary artery disease [25] [26]. In addition, CAC testing increases compliance with lifestyle changes because it educates the patient with his/her actual cardiovascular risk [27]. It is superior to many other tests that are used to predict cardiovascular events, including coronary angiography, stress testing, and risk calculations based on risk factors [28] [29]. Although there are ethnic differences in the prevalence of calcium score positivity [30], the predictive value of CAC scoring for ASCVD outcomes is similar in different ethnic groups [19].

CAC testing detects the calcium in the wall of the coronary artery, not the atherosclerotic plaque itself. However, this detection is sufficient to diagnose coronary artery disease since there are no false positive results (if the calcium score is greater than zero, atherosclerotic plaques are present). Individuals with a zero CAC score may have non calcified atherosclerotic plaques but these are usually few in number and relatively stable [31]. This is the reason that a zero CAC score indicates a very low 5 year event rate, even in a diabetic population [32]. In contrast, even a very low positive score (1 to 10) increases the risk at least three-fold [33]. Therefore, we recommend treatment of all individuals with a positive calcium score greater than one.

Guideline #2: *All patients with positive CAC scores* (>0) *should be treated to lower their LDL-C below* 50 *mg/dl.*

There are no safe positive CAC scores. As soon as an individual develops a positive score, medical treatment is warranted [34]. Studies demonstrate that the lower the LDL-C, the lower the incidence of an ASCVD event [35] [36] [37]. The goal of these guidelines is to prevent all ASCVD events in all patients (**Table 1**). Regression of atherosclerosis with medical therapy has been documented in many studies [38]. Treatment is very cost effective considering that the combination of ezetimibe 10 mg/day and rosuvastatin 10 mg/day is approximately 50 cents [39].

Guideline #3: *Ezetimibe 10 mg/day should always be ordered whenever ordering a statin to lower LDL-C.*

Statin's primary metabolic effect is to reduce the hepatic production of cholesterol. Statins are both safe and effective [40] [41]. Statin's activity reduces the hepatic content of cholesterol. In response, there is a genetic activation to increase hepatic cholesterol from other sources [42] [43] [44] [45]. At least two sources are activated. First, the intestinal absorption of cholesterol is increased [46]. Second, the reuptake of cholesterol from the bile into the liver is also increased. Ezetimibe counteracts both of these sources and thereby enhances the effects of statins in lowering circulating LDL-C [47] [48]. Ezetimibe in combination with statins also reduces coronary artery plaque volume [49]. Randomized clinical trials demonstrate ezetimibe's effectiveness [50].

Guideline #4: *Every asymptomatic diabetic patient should be risk stratified with a CAC score before deciding to initiate statin therapy. Diabetes should not*

be considered a coronary artery disease equivalent.

Many previous guidelines recommended that all diabetic patients be routinely treated with statin therapy without risk stratification. Newer data now suggests that diabetes is not equivalent to symptomatic ASCVD [51]. Although ASCVD is more prevalent in patients with diabetes, individuals with a zero calcium score have non-significant increased event rates comparable to non-diabetic individuals without diabetes [32]. There are no data that treating diabetic patients with zero CAC scores with statins reduces the incidence of an ASCVD event [51].

Guideline #5: *It is not necessary to start medical therapy on anyone with a zero calcium scan unless his/her major risk factors are very significant. Diabetes is discussed in guideline #*4.

A zero CAC scan should be repeated in four to five years (depending on perceived risk). The reason for this repetition is that at four years, 13.4% of zero score individuals will now have a positive score. At 5 years, 25.1% of zero scored individuals will have a positive score [52].

A zero CAC score is reassurance to the patient that his cardiovascular risk is very low [53] [54] [55]. However, the presence of cardiovascular risk factors may influence the physician to treat the patient, at least by recommending an improved lifestyle and reduction or control of major risk factors. Alternatively, the physician may choose to order coronary CT angiography to better define the presence of non calcified plaques. However, this procedure is riskier, more expensive, more time consuming, involves additional radiation exposure, and tends to be performed only at major health centers.

Guideline #6: *The lipid goal is to reduce LDL-cholesterol* (*LDL-C*) *to* 50 *mg/dl or less, therefore medically treat all patients with a positive CAC scan if LDL-C is above* 50 *mg/dl.*

The evidence for this guideline is based on observations from groups of individuals with known cardiovascular disease who are prescribed high intensity statins to lower their LDL-C [56]. At a group mean LDL-C level of 72 mg/dl, approximately 50% of the individuals reduce their plaques whereas 50% increase their plaques [57]. It is unknown what the rate of plaque increase/decrease is above or below 72 mg/dl but assuming the response is a bell shaped statistical curve, then below 50 mg/dl would seem a reasonable goal for 99% reversal. This goal assumes that other ASCVD risk factors are well controlled in addition to LDL-C. One study in the clinical setting demonstrated that no asymptomatic individuals with a positive CAC score and an LDL-C below 60 mg/dl developed symptomatic ASCVD over a 3.5 year observation period [58]. The other reason that an LDL-C goal of 50 mg/dl is recommended is that it is achievable in almost all compliant individuals taking rosuvastatin 10 mg/day plus ezetimibe 10 mg/day and a low cholesterol diet [59] [60]. There are no proven hazards to very low LDL-C levels [61] [62] [63].

Guideline #7: *The recommended starting dose of rosuvastatin is* 10 *mg/d, ezetimibe* 10 *mg/d, and a low cholesterol diet* (*less than* 200 *mg of cholester-*

ol/day). *If this is unsuccessful at achieving the LDL-C goal and compliance is good, consider alterative lipid lowering therapies.*

LDL-C is a FDA acceptable surrogate marker for cardiovascular disease medication effectiveness [64] [65]. Statins are the primary therapeutic modality because of their proven efficacy in preventing ASCVD [66]. Myalgia is rare and often difficult to document [67]. Rosuvastatin is the best choice of statin because it is the most potent statin and is available in generic form [68] [69]. It also is not metabolized by the liver but is excreted almost entirely by the kidney [70]. Since the side effects of statins are dose related, it is rarely necessary to increase the dosage above 10 mg/day [66. In addition, each doubling of a statin dose only results in a 6% increase in LDL-C lowering [71]. We also add ezetimibe 10 mg/day to the statin because this medication complements the metabolic effect of statins to further lower the LDL-C [72]. The primary target of activity of statins is the liver to reduce cholesterol production whereas the primary target of ezetimibe is the intestine to block cholesterol absorption. A low cholesterol diet is essential to achieve maximum lowering of plasma LDL-C [58]-[74]. Other lipid lowering medications are expensive and often require preauthorization from the insurance company [75].

Guideline #8: *In patients who are "intolerant" of statins, consider starting rosuvastatin slowly,* 5 *mg once per week, ezetimibe* 10 *mg/day, and a low cholesterol diet. Advance the rosuvastatin as tolerated up to* 10 *mg/day.*

Double-blinded, randomized, controlled studies demonstrate that statin intolerance and myopathy are very infrequent [67] [76]. In addition, the side effects of statins are dose related so that by keeping the dose low, side effects are minimized. Starting with 5 mg of rosuvastatin each week with an increase as tolerated is a successful approach to convincing patients that rosuvastatin rarely causes side effects [77] [78]. Neither ezetimibe nor a low cholesterol diet has any significant side effects [79]. Furthermore, the FDA no longer recommends that liver function tests be monitored after starting statin therapy [80]. It is unfortunate that the social media has promulgated an untrue and dangerous statin reputation [41].

Guideline #9: *If fasting triglycerides are elevated* (>150 *mg/dl but* <500 *mg/dl*), *correct secondary causes of hypertriglyceridemia and if indicated, initiate fenofibrate and statin therapy. If triglycerides are greater than* 500, *there is a risk of pancreatitis and lipid specialty consultation is indicated.*

The remnant particles from the metabolism of triglycerides containing particles (chylomicrons and VLDL) are atherogenic and contribute to plaque development [81]. Triglyceride particles can come from both the liver and the gut but both are metabolized by lipoprotein lipase. When lipoprotein lipase is impaired or poorly functional, then prolonged hypertriglyceridemia occurs. The result is that the vascular endothelium is exposed continuously to triglyceride remnant particles. Fenofibrate is beneficial in lowering cardiovascular risk [82]. Studies in men have examined the effect of lowering triglycerides over 200 mg/dl

and demonstrated a beneficial effect on cardiovascular disease reduction [83]. No benefit was observed for fasting triglycerides less than 200 mg/dl.

Guideline #10: *Low-dose aspirin* (82 *mg/day*) *is recommended for individuals with a CAC score* > 100 *for a maximum period of two years of medical treatment. Aspirin is not recommended for individuals greater than* 65 *years of age because the risk of bleeding outweighs the benefits.*

Aspirin has been traditionally used in the treatment of cardiovascular disease because of its antiplatelet and anticlotting effects [84]. Many randomized controlled trials have demonstrated its small benefit [85]. However, recent trials have emphasized the adverse effects of aspirin including gastrointestinal hemorrhage [86] [87] [88] [89] [90]. Therefore, the physician must consider the risk/benefit ratio in deciding whether to prescribe aspirin therapy. Based on these data, we recommend aspirin therapy if the CAC score is greater than 100 and the subject is less than 65 years old (bleeding is increased in the elderly) [91]. If aspirin is prescribed, we do not recommend its use for longer than 2 years since regression of atherosclerotic plaques is readily identified by that time [92].

Guideline #11: *To achieve an LDL-C below* 50 *mg/dl, a low cholesterol diet* (<200 *mg/day*) *is essential.*

The average American diet includes approximately 400 mg/day of cholesterol [60]. About 100 mg of this cholesterol is absorbed into the hepatic circulation [93]. Much of this cholesterol is subsequently utilized in the formation of atherogenic lipoproteins [94]. Ezetimibe can only block up to 50% of this enteric derived cholesterol from absorption [95]. A low cholesterol diet is readily achievable if food stuffs high in cholesterol are avoided. Egg yolks, meat products, and dairy products should be consumed very sparingly [96]. Vegetables contain no cholesterol and should be encouraged [97]. All patients should obtain a book on the cholesterol content of foods. Our patients utilize The Complete Book of Food Counts by CT Netzer, which is available from Amazon.com for $9.95 [97].

Guideline #12: *Exercise is beneficial in many metabolic ways but it has a minimal effect on lowering LDL-C.*

Patients will ask about exercise to lower LDL-C. All healthy lifestyle recommendations include a prescription for increasing exercise to a minimum of 30 minutes five times/week. Exercise results in many beneficial metabolic changes, both in muscle and adipose tissue. Studies of well-being and life span in exercising individuals demonstrate a prolonged lifespan with fewer comorbidities [98].

Whether it is the exercise, per se, or the healthier lifestyle and diet followed by most athletes is difficult to determine. In any event, lipid values in exercising individuals are only mildly improved compared to non-exercising individuals (elevation of HDL-cholesterol and slightly lower LDL-C) [99]. We encourage exercise (primarily walking) in our patients within the limits of safety. However, we also encourage them to take the prescribed medications to lower their LDL-C < 50 mg/dl.

Guideline #13: *As part of the assessment of risk, measure both fasting Lipoprotein (a) (Lp(a)), high sensitivity C-reactive protein (hsCRP), and calculate non-HDL total cholesterol. The higher the risk, the lower the LDL-C should be. There is no "threshold" of benefit for LDL-C lowering.*

Understanding why a calcium score is positive is important to choosing the correct therapy. Lipoprotein (a) is a circulating particle that is atherogenic and primarily inherited. Unexpectedly, statins usually increase Lp(a) [100]. PCSK9 inhibitors significantly lower Lp(a) concentration [101]. At this time, it is not known whether lowering lipoprotein (a) is beneficial. High sensitivity C reactive protein is an indication of the general status of inflammation in the body. Inflammation is an important ASCVD risk factor [102] [103] [104]. As a surrogate for the degree of inflammation, hsCRP's elevation (>1.0 mg/dl), is associated with endothelial damage and movement of cholesterol containing particles into the coronary artery wall [105]. Reducing hsCRP to normal should be a goal for reducing inflammation [103] [106]. Non-HDL cholesterol is a good measure to asses all the atherogenic lipoproteins. It normally is about 30 mg/dl higher than LDL-C and easily calculated from a lipid profile (total cholesterol minus HDL cholesterol). Some studies have shown that it is a better predictor for atherosclerotic events than LDL-C because it measures the cholesterol in all atherogenic particles, not just LDL-C [107].

Guideline #14: *If mild symptoms of stable angina occur (e.g. with exercise), increase aggressive medical therapy to lower all risk factors. Be certain that LDL-C is below 50 mg/dl. Unstable angina (angina at rest) requires emergency referral to a cardiologist or emergency room.*

A patient with stable angina does not necessarily have to be referred to a cardiologist [108]. Three recent placebo-controlled, randomized clinical trials have demonstrated that medical therapy is similar in outcome to invasive placement of a coronary stent [109]. Stabilization and regression of the coronary artery plaque will occur with aggressive medical therapy [38]. Beneficial effects of statin therapy on plaque stabilization can be observed within 30 days [92]. Close patient followup is warranted to be certain that the patient is improving.

Guideline #15: *It is very important to normalize the major risk factors for atherosclerosis including cessation of smoking, normalization of blood pressure, control of hyperglycemia, normalization of triglycerides (<150 mg/dl), and LDL-C (<50 mg/dl).*

As a general rule, 50% of the risk of ASCVD is attributable to genetic predisposition and 50% due to environmental factors [110] [111]. Glucose control as assessed with hemoglobin A1C is highly correlated with CAC scores [112]. Many environmental factors can be controlled, and a few cannot, such as gender [113]. There are several minor risk factors but the most important major ones are LDL-C, smoking, hypertension, and diabetes [114] [115] [116]. Each of these major risk factors can cause coronary artery endothelial damage thereby permitting additional LDL-C particles entrance into the coronary artery subendothelial

space [117]. This process is the start of metabolic pathophysiology which transits through fatty streaks, plaque formation, and eventual plaque rupture, resulting in a myocardial infarction [118].

Guideline #16: *A repeat CAC score is unnecessary for patients with known symptomatic atherosclerotic cardiovascular disease. It will almost always be positive.*

When a patient has had a cardiovascular event, the cause is usually plaque rupture into the coronary artery. Exceptions to this rule are two/fold. Calcification of coronary artery plaques occurs after the progression of fatty streaks into nascent plaques [119]. Non calcified plaques will occasionally rupture. Second, myocardial infarction is not always associated with plaque rupture but may occur when the arterial endothelium is damaged and releases thrombogenic substances which attract leukocytes and platelets [120]. An arterial thrombosis may then result. Patients who have a documented ASCVD event should always be treated aggressively to lower their LDL-C < 50 mg/dl.

Guideline #17: *When statins are started in a patient with a positive coronary artery calcium scan, monitor the hemoglobin A1C which will tend to increase. Treat with antidiabetic medications to keep the A1C at goal for that patient.*

All statins tend to increase plasma glucose concentration in a dose response relationship [121]. This is one reason that it is best to prescribe low dosages of these medications. For rosuvastatin, 10 mg/day does not cause an increase in diabetes [122] but when used at a dose of 20 mg/day or above, it does [123] [124]. However, if the hemoglobin A1C starts to rise after statins are initiated, counteract this effect by intensifying anti-diabetic medications. All studies have demonstrated that the beneficial effects of statins far outweigh the minor negative effects of statins on glucose control [125].

Guideline #18: *A repeat CAC score in a patient with a positive score is unnecessary. Calcium in the wall of the artery almost never regresses.*

Patients will often request a repeat CAC score to assess reduction of the calcium score as an indication of plaque regression. However, since statins increase coronary artery calcium, total calcium almost always increases with time [126]. Specifically, statins increase the density of the calcium thereby increasing the calcium score and further stabilizing the plaque while vessel remodeling occurs. Studies have demonstrated that as a group, calcium scores will increase at a greater rate in untreated individuals compared with statin treated individuals [119]. However, the wide variation in individual responses makes it difficult for the calcium score to be predictive of regression in the individual patient.

Guideline #19: *Patient involvement with CAC testing is necessary to achieve an LDL* < 50 *mg/dl goal.*

Compliance with statin therapy in the adult population is poor when using equations to predict ASCVD risk. For example, at five years, >50% of seniors are no longer taking prescribed statins [127]. This results in few individuals reaching their target LDL-C goal [128] [129]. In contrast, CAC testing with patient in-

volvement and understanding improves compliance with medication adherence and beneficial lifestyle changes [130]. Discussions with the patient on the meaning of a positive CAC score and the fact that atherosclerosis is reversible is important. Review of the entire CAC score report with the patient and its detailed specific coronary artery pathology plus any peripheral chest abnormalities will emphasize the benefits of medication adherence and close medical follow up [130] [131]. Frequent testing with a lipid profile will identify noncompliance and provide a positive incentive for patient adherence. Based on the pharmacodynamics of rosuvastatin for steady state concentration to be attained, we recommend that lipids should be measured at two months following statin initiation and every four to six months thereafter when steady state has been achieved [132].

Guideline #20: *Expert consultation for difficult ASCVD clinical problems in asymptomatic individuals should be obtained.*

Many academic medical centers provide free consultation for out of network physicians and caregivers. Most questions can also be answered by downloading our free book: 50 Ways to Save Your Heart at stopheartattack.net. Authors of this set of guidelines are available at schadeds@gmail.com for any clinical issues that arise relative to following these guidelines. Please follow HIPAA confidentiality guidelines and do not include any patient personal information in your email request.

5. Discussion

The guidelines detailed above present a feasible approach to preventing cardiovascular disease. Each guideline is supported by published data and the citations provide additional information for the reader. The authors attempted to provide a complete, but relatively straightforward approach for the practicing clinician to discuss with his/her patients. The authors acknowledge that not every patient will be successful at following these guidelines, but the vast majority should have no difficulty adhering to these recommendations. The authors (Schade and Eaton) have been adhering to these guidelines for the last five years in their cardiovascular prevention clinic with much success as previously described [58]. Achieving an LDL cholesterol of less than 50 mg/dl is not only achievable in almost all patients but also readily accomplished without requiring a major change in lifestyle. Providing a realistic goal for LDL cholesterol gives the patient an achievable target to prevent cardiovascular disease. Once the patient understands the purpose of the goal and what it will do for that individual, compliance is greatly improved. Many of our patients achieve an LDL cholesterol significantly below 50 mg/dl when they are participating in their own therapy. When patients understand that atherosclerotic heart disease is not only preventable but reversible, it provides a strong incentive to achieve their LDL cholesterol goal. This fact is particularly important in individuals with a strong family history of cardiovascular disease.

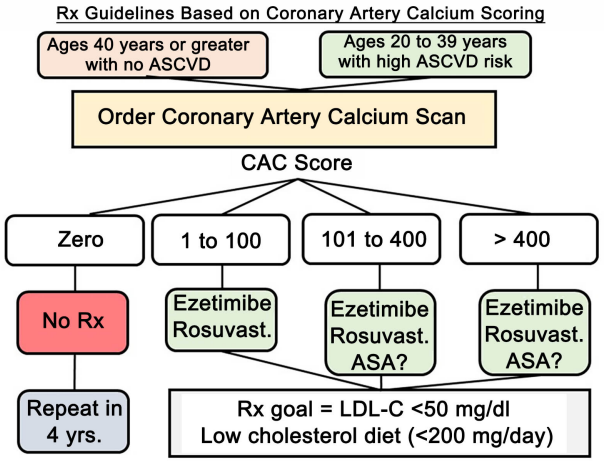

Figure 1. Sequential approach to prevention of symptomatic atherosclerotic cardiovascular disease based on a coronary artery calcium score. Use of aspirin is based on age. Abbreviations: CAC = coronary artery calcium; Rosuvast. = rosuvastatin; LDL-C = low density lipoprotein cholesterol; Rx = treatment; ASA = low dose aspirin (82 mg/day); ASCVD = atherosclerotic cardiovascular disease.

6. Conclusion

The above guidelines, **Figure 1** and **Table 1** provide a rational approach to preventing clinically evident cardiovascular disease. They provide a comprehensive approach that any clinician can follow. The use of the coronary artery scan to identify subclinical cardiovascular disease removes the "guesswork" that is always present when using risk equations to calculate future risk. It also simplifies the task of the physician in convincing his/her patient that subclinical heart disease is present and hazardous. Since coronary artery atherosclerosis always progresses unless aggressively treated, the patient can readily understand the danger of avoiding treatment. Most patients want to take charge of their health and prevent whatever disease they can. Providing patients and clinicians with a simple, viable, and life-saving alternative to no or minimal treatment is the purpose of these guidelines.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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