Management of Dyslipidemia and Weight Reduction in Metabolic Syndrome: An Evidence Based Change in Practice Proposal

NURS 595 Focused Scholarly Project

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Introduction

Obesity and cardiovascular disease (CVD) currently plague the nation. CVD is the leading cause of death, and 69% of American adults are classified as being overweight (Centers for Disease Control and Prevention (CDC), 2014; World Health Organization (WHO), 2013). Metabolic syndrome is a cluster of co-existing symptoms that place an individual at increased risk for cardiovascular disease. The management of metabolic syndrome is a constant challenge faced by nurse practitioners (NP) in a clinic setting. It has been estimated that patients with metabolic syndrome have twice the chance of developing CVD and five times the chance of developing non-insulin dependent diabetes (DM2) (Kaur, 2014). This article focuses on the management of two modifiable risk factors: dyslipidemia and obesity. A change in practice is proposed for the NP based on the most current research and statements issued by major medical organizations.

Background Information

What is an Apo-B?

All low density lipoprotein (LDL-C) and very low density lipoprotein (VLDL) molecules are hydrophobic, and therefore, must be packaged into hydrophilic protein particles in order to travel in the plasma and enter the vessel intima to form atherosclerosis (Gleeson & Davidson, 2010). Measurement of serum LDL-C provides an estimate of the amount of cholesterol packed into one particle; measurement of an atherogenic apolipoprotein particle (Apo-B) yields the actual number of cholesterol packed particles free floating in the bloodstream. It is estimated that ninety percent of cholesterol contained
within the Apo-B is atherogenic, including LDL-C and VLDL (Cromwell, Otvos, Keyes, Wilson & Agostino, 2007; Gleeson & Davidson, 2010).

Pathogenesis of Metabolic Syndrome

Metabolic syndrome is a cluster of conditions that significantly increase a patient’s risk for diabetes and cardiovascular disease. In order for a patient to be diagnosed with metabolic syndrome they must exhibit three out of five of the following conditions: impaired fasting glucose, hypertension (HTN), increased triglycerides, decreased high density lipoproteins (HDL), and central obesity (Kaur, 2014). While the pathogenesis of metabolic syndrome is still not fully understood, it is believed to increase risks for comorbidities by inducing a chronic state of low grade inflammation (Kaur, 2014). An overweight or obese individual has an increase in amount, as well as hypertrophy and dysfunction of stored adipocytes. These diseased adipocytes cause hormonal dysfunction and increase endogenous production of pro-inflammatory responses. This phenomenon is chronic and its potential effects on other organ systems are thought to contribute to atherosclerosis by directly causing or worsening existing cases of DM2, HTN, and dyslipidemia (Bay et al., 2013).

Problem Statement

Despite technological advances and increased awareness, CVD remains the leading cause of death in the United States (WHO, 2013). Atherosclerosis is a known contributor to the development of coronary artery disease, and it is a manageable risk factor. Those with metabolic syndrome have a unique pattern of dyslipidemia that usually includes low HDL-C and high triglycerides (Bays et al., 2013; Garber et al., 2013; Kaur, 2014). Clinicians assess the risk for atherosclerotic development by monitoring serum lipid levels. In the past, the serum level of LDL-C was used as the goal outcome measure of effective lipid management;
this is changing for those patients with dyslipidemia associated with metabolic syndrome. More recent evidence suggests that there is a better indicator of cardiovascular disease, serum low-density lipoprotein particle numbers, which can be measured by drawing a serum lab test termed Apo-B (Bays et al., 2013; Cromwell et al., 2007). Lifestyle modification continues to be a significant component of the clinician issued treatment plans also, and this has recently changed as well. The American Heart Association (AHA) recently stated that dietary modification for lipid control should include a dietary pattern that emphasizes the intake of vegetables, fruits, whole grains, low-fat dairy products, poultry, fish, legumes, non-tropical vegetable oils and nuts, as well as limiting intake of sweets, sugar-sweetened beverages, and red meats (Eckel et al., 2013). The National Lipid Association (NLA) released a consensus statement highlighting the importance of a low carbohydrate intake in order to reduce lipid values, especially when high triglycerides are present (Bays et al., 2013). These updated diet recommendations differ from those that have been recommended in past years, where the focus lied in reduction of dietary cholesterol and fat intake.

**Review of Literature**

A search of the literature conducted using key phrases, LDL-Ps, NMR, GI diet, and atherosclerotic causes generated a larger quantity of studies. The search was further refined through use of secondary questions: Is LDL-P count a better predictor of CVD than low density lipoprotein cholesterol; does LDL-Ps contribute to atherosclerotic build-up; do LDL-Ps correlate with triglyceride level; and does GI diet affect LDL-P count.

Electronic databases and Internet search engines were utilized. Databases included Cochrane, ProQuest, PubMed, and Google Scholar. The search, regardless of database, was limited to articles in English only, full-text, and published after 2005. As the research
process developed, an ancestry approach emerged; the topic of LDL-P measurement as an indicator for CVD is a new topic of interest for practicing clinicians, but original studies regarding this topic were published in the early 2000’s and accessed through reference lists of more recently published scholarly articles. The studies presented are not all inclusive, and were chosen specifically to discuss the topic of interest for this article.

**Apo B as a serum marker for CVD Risk**

Cromwell et al. (2007) examined lipid profiles, including Apo-B measurements, of three thousand sixty-six qualifying persons who participated in the Framingham offspring study and identified a worrisome discrepancy between serum LDL-C and Apo-B in more than twenty percent of participants. Levels of Apo-B rise more with increasing triglycerides than do levels of non–HDL-C. Researchers reported that in subjects with LDL-C between 100 and 129 mg/dL, LDL-P was 40% higher (1652 vs 1179 nmol/L) and non–HDL-C was 31% higher (168 vs 128 mg/dL) in those with triglycerides 200 mg/dL compared to 100 mg/dL. Serum LDL-C levels did not respond with the rise in triglycerides and were identical in these two groups. In situations where these two values did not exhibit a direct relationship, termed “discordance”, Apo-B proved to be a better indicator for future CVD. When Cromwell et al. compared each lipid value and its strength in association with known CVD events amongst male and female participants, the Apo-B was twice as strongly related to CVD events than LDL-C. Discordance is particularly dangerous when using LDL-C as a measurement for therapeutic outcome, because it underestimates a person’s risk for atherosclerotic build-up and CV events.

In addition to Apo-B number, it is believed that Apo-B size contributes largely to atherosclerotic disease. Hulthe, Bokeman, Wikstrand, and Fagerberg (2000) found that
participants with small, dense Apo-Bs exhibited higher mean values than those with larger particles for basal metabolic index, total serum cholesterol, triglyceride levels, blood pressure, heart rate, and serum insulin, and lower high-density lipoprotein (HDL) levels. Results also showed a greater prevalence of plaque build up in the carotid artery via ultrasound in participants with small, dense lipoprotein particles. The existence of small lipoprotein particles increases the likeliness of discordance, because smaller particles carry smaller amounts of cholesterol, yielding a misleading low serum LDL-C (Cromwell et al., 2007). Discordance can exist amongst any individual but is most expected in the coexistence of abnormally high triglycerides, decreased LDL particle size, and normal LDL-C (Cromwell et al., 2007; Hulthe et al., 2000).

The American Association of Clinical Endocrinologists (AACE) issued a consensus statement recognizing the significance of measuring an APO-B in those patients with DM2. Patients are separated into risk categories based on their conditions. Diagnosed DM2 places them at moderate risk. DM2 coupled with two or more other risk factors are considered high risk; those with metabolic syndrome will fall into this category. A third category is comprised of those with DM2 and document coronary disease, and these patients are considered very high risk. The AACE defines a desirable Apo-B as less than 90 mg/dL in moderate risk categorized patients and less than 80 mg/dL in those placed in the high and very high risk categories. The AACE acknowledges the existence of discordance between the LDL-C and Apo-B and recommends more aggressive pharmacological management until the Apo-B falls into the desirable range. (Garber et al., 2013)
Dietary Interventions

Aude et al. (2004) performed a randomized control trial in which a restricted calorie low-saturated fat and high-carbohydrate diet was compared to a isocaloric modified low-carbohydrate (low total carbohydrates, but higher in protein, monounsaturated fat, and complex carbohydrates) diet; the latter produced a greater reduction in weight loss, serum lipid levels, and waist circumference. Encouraging results were contributed to the low glycemic load entailed within this diet.

Krauss, Blanche, Rawlings, Fernstrom, and Williams (2006) completed a study with 178 men. The men were separated into three groups and assigned diets that differed in carbohydrate load and fat intake. The measurable reduction in serum LDL-C was greater with the 54% carbohydrate diet than with the 26% carbohydrate diet. The 26% carbohydrate diet exhibited decreases in all lipid levels including Apo-B. Kraus et al concluded that moderately reduced carbohydrate diets with higher protein and complex carbohydrate content yielded decreases in serum LDL-C, Apo-B, triacylglycerols, total, and small, dense LDLs and increased HDL-C.

Robert (2010) published a literature review comparing different diet types. Low-fat diets had a greater effect on total cholesterol and LDL-C levels, and a twelve percent decrease in total-HDL cholesterol ratio. Low-carbohydrate diets had a greater effect on triglycerides and HDL cholesterol, and twenty percent decrease of total-HDL cholesterol ratio. According to Robert, low GI diets were less researched, and results did not yield significant changes in total cholesterol levels; no mention of Apo-B was specifically mentioned.
Ebbeling et al. (2012) compared low-saturated fat, low-carbohydrate, and low GI (entails moderate amounts of complex carbohydrates including fiber-rich beans, lentils, non-starchy vegetables, fruit and whole grains, as well as lean proteins and healthy fats) diet’s effects on energy expenditure after weight loss. Low-fat and low-carbohydrate diets yielded slightly more weight loss than did a low GI diet; however, weight loss maintenance was greatly improved in the latter. Low-carbohydrate diets resulted in the most weight loss and highest boost in metabolism, but it was also associated with increased cortisol and C-reactive protein levels, both thought to play significant roles in atherosclerotic development. A low GI diet yielded nearly similar weight loss without increases in the stress hormone and inflammatory marker. Ebbeling et al. concluded a low GI diet was the best overall diet plan for weight loss management, maintenance, and CVD prevention. It did not evaluate its direct effect on serum Apo-B.

Bailey, Westman, Marquart, and Guyton (2010) conducted a study to evaluate the effects of dietary counseling on a low glycemic index diet amongst those patients suffering from hypertriglyceridemia. The study was conducted from 1998-2004 and patients had to have an initial fasting triglyceride greater than 200 mg/dL. The results concluded that those patients compliant with the diet showed an intake of 44% carbohydrate calories, 32% fat, 22% protein, and 2% alcohol; these patients achieved a mean three percent weight loss after one year and maintenance of such. The weight loss directly correlated with decreased triglycerides (-2.6 mg/dL per kilogram and increased HDL-C). The research was presented out of the Duke University. The Duke University Lipid Clinic endorses a low glycemic index diet for management of resilient dyslipidemia.
Analysis of Literature

Properly identifying, managing, and evaluating patients at increased risk for cardiovascular disease are important skills for Nurse Practitioners (NPs) to exhibit. The literature strongly identifies the Apo-B as a significant serum marker for risk assessment and treatment outcomes. The danger in not incorporating the Apo-B into routine management of dyslipidemia is identified by discordance of the LCL-D and Apo-B values. This discordance is highly related to decreased HDL-Cs and increased triglycerides; this unique pattern of lipid levels is categorical and diagnostic of those with dyslipidemia of the metabolic syndrome. Therefore, not incorporating assessment of the Apo-B into routine screening and management of dyslipidemia may be suboptimal treatment for those with metabolic syndrome.

Dietary management continues to play a pivotal role in reducing lipid levels and a patient’s CV risk. A number of effective dietary combinations are available for the NP to utilize. The chosen diet should be tailored to each individual patient’s medical condition, culture, and financial state. One fact that remains clear throughout the literature is that processed sugars and carbohydrates are a larger problem source than originally thought. The food pyramid, which placed its focus on decreasing dietary fat and cholesterol intake, is no longer utilized when teaching a patient about a balanced diet. While saturated fat intake should still be considered in dietary management for those with dyslipidemia of the metabolic syndrome, it should be secondary to the focus placed on carbohydrates content and the glycemic load of each food. Due to elevated Apo-B often being associated with increased triglycerides and decreased HDL, it is hypothesized that a diet that lowers simple sugar
intake, stabilizes blood sugar, and increases healthy fat intake, such as the low GI diet, would serve to improve serum levels of these markers (Bailey et al., 2010).

**Strategy for Change**

CVD secondary to metabolic syndrome continues to be a great challenge that the NP is faced with. It is a chronic, multifaceted disease process with both modifiable and non-modifiable risk factors. Amongst the modifiable risk factors are dyslipidemia and obesity. The literature presented suggests that NPs can do a better job at managing both simultaneously with two interventions. First, the NP should incorporate an APO-B measurement into routine lipid screenings in all pre-diabetic patients and those who meet the criteria for DM2 and metabolic syndrome (Garber et al., 2013). The Apo-B should also be used as a goal outcome measure, and this patient’s lipid management should only be considered optimal when the Apo-B is within the recommended range, as well as other lipid levels (Bays et al., 2013; Cromwell et al., 2007; Garber et al., 2013). Second, the NP should strongly counsel and recommend a combination of vegetables, fruits, whole grains, and lean proteins, low-fat dairy products, legumes, non-tropical vegetable oils and nuts with avoidance of sweets and sugar sweetened beverages (Eckel et al., 2013). A low glycemic index diet has been proven to be beneficial to those patients with dyslipidemia and isolated hypertriglyceridemia, and it should be integrated into practice management appropriately.

The implementation of the aforementioned changes is best suited to the NP working in a clinic setting in which management of chronic conditions is a daily task. The presented information is especially useful to those NPs practicing in family practice, cardiovascular specialty, and endocrine specialty settings. Regular outcome evaluation and conducive follow
up is necessary in order to assure appropriate management through utilization of the extra laboratory markers.

Implications

Practice

The precepts of the Health Promotion Model (HPM), developed by Nola Pender, align with this topic. Pender’s model aims to influence healthy behaviors by use of positive motivation. It is based on the belief that a person’s health is affected by individual, environmental, and societal influences, and therefore, nurses should seek to empower persons with the necessary information to overcome health barriers and create behaviors leading to optimal health and wellbeing (Gonzalo, 2011). Assumptions of this model include: individuals seek to actively regulate their own behavior; individuals in all their biopsychosocial complexity interact with the environment, progressively transforming the environment and being transformed over time; health professionals constitute a part of the interpersonal environment, which exerts influence on persons throughout their life span; and self-initiated reconfiguration of person-environment interactive patterns is essential to behavior change (Gonzalo, 2011). By remaining up to date on the management of conditions such as the dyslipidemia of metabolic syndrome, educating patients, and incorporating lifestyle modification into treatment regimen, the NP adheres to the HPM.

The risks and benefits of a change in practice should always be thoroughly assessed in regards to the health of the patient. For example, the effects of this proposed change could be evaluated longitudinally by NPs who implement the recommendations. The effects should be monitored through routine physical examinations and quarterly laboratory assessments conducted by the NP. These changes are suggested to be used in conjunction with and not
opposed to currently used means of treatment and outcome evaluation. Even with the most
desirable laboratory markers, the NP must be mindful of the differing risks and comorbidities
associated with metabolic syndrome. Emphasis on other risk factors should be paid attention
to and managed as aggressively as dietary modification and dyslipidemia. As always, a
holistic view of the individual must be considered and decisions should contribute positively
to the state of overall health of the patient.

Future Research

Future research should be focused on morbidity and mortality rates secondary to
cardiovascular disease when the ApoB aggressively managed. Will management of this
particular lab value make a statistical difference in the number of people suffering from
cardiac events?

Conclusion

Cardiovascular disease and metabolic syndrome are two conditions that have a high
incidence and prevalence in the United States. Management of these conditions are a task
that every NP will be faced with at one time or another. Incorporating the ApoB
measurement into routine laboratory measurements for those patients diagnosed with
metabolic syndrome more accurately identifies their cardiovascular risk, and leads to better,
more comprehensive management of the condition. Dietary modifications should be
incorporated based on the latest research and recommendations from professional
organizations. A diet focused on carbohydrate restriction more so than dietary cholesterol
intake is the cornerstone of dietary management regimens for the patient with dyslipidemia
associated with metabolic syndrome. By taking into consideration the presented evidence and
adhering to professional guidelines, the NP will better assess, diagnose, treat, and evaluate
the treatment of dyslipidemia, especially that categorically associated with metabolic syndrome.
References


Bailey, W., Westman, E., Marquart, M., & Guyton, J. Low glycemic diet for weight loss in hypertriglyceridemic patients attending a lipid clinic. *Journal of Clinical Lipidology, 4*(6). DOI: [http://dx.doi.org/10.1016/j.jacl.2010.08.019](http://dx.doi.org/10.1016/j.jacl.2010.08.019)


Eckel, R., Jakicic, J., Ard, J., Hubbard, V., De Jesus, J., Lee, I., Lichtenstein, A., Loria, C.,
Millen, B., Miller, N., Nonas, C., Sacks, F., Smith, S., Svetkey, L., Wadden, T., &
Yanovski, S. (2013). 2013 AHA/ACC guideline on lifestyle management to reduce
cardiovascular risk: A report of the American College of Cardiology/American Heart
Association task force on practice guidelines. *Circulation*. DOI:
10.1161/01.cir.0000437740.48606.d1

Garber, A., Abrahmanson, M., Barzilay, J., Blonde, L., Bloomgarden, Z., Bush, M., Dagogo-
Jack, S., Davidson, M., Einhorn, D., Garvey, T., Grunberger, G., Handelsman, Y.,
Hirsch, I., Jellinger, P., McGill, J., Mechanick, J., Rosenblit, P., Umpierrez, G., &
comprehensive diabetes management algorithm 2013 consensus statement.
*Endocrine Practice* 19(2). Retrieved from https://www.aace.com/files/consensus-
statement.pdf

lipid management*. Milwaukee, WI: Prevent CVD, LLC.


LDL particle size, and atherosclerosis: the atherosclerosis and insulin resistance
(AIR) study. *Arteriosclerosis, Thrombosis, and Vascula Biology*, 20. Retrieved from
http://atvb.ahajournals.org/content/20/9/2140.full.pdf+html
http://dx.doi.org/10.1155/2014/943162

