Lipids and Bariatric Procedures Part 2 of 2: Scientific Statement from the American Society for Metabolic and Bariatric Surgery (ASMBS), the National Lipid Association (NLA), and Obesity Medicine Association (OMA)*

EXECUTIVE SUMMARY

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ABSTRACT

Bariatric procedures generally improve dyslipidemia, sometimes substantially so, as well as improve other major cardiovascular risk factors. This two part Scientific Statement examines the lipid effects of bariatric procedures, and represents the contributions from authors representing the American Society for Metabolic and Bariatric Surgery (ASMBS), the National Lipid Association (NLA), and the Obesity Medicine Association. The foundation for this scientific statement was based upon data published through June 2015. Included in Part 2 of this comprehensive scientific statement is a review of: (1) the importance of nutrients (fats, carbohydrates, and proteins) and their absorption upon lipid levels; (2) the effects of bariatric procedures on gut hormones and lipid levels; (3) the effects of bariatric procedures on non-lipid cardiovascular disease (CVD) risk factors; (4) the effects of bariatric procedures on lipid levels; (5) effects of bariatric procedures upon CVD, and finally (6) the potential lipid effects of vitamin, mineral, and trace element deficiencies, that may occur after bariatric procedures. This document represents the Executive Summary.

KEY WORDS: dyslipidemia; lipid values; cardiovascular disease; bariatric surgery; obesity; micronutrients; vitamins; gastrointestinal hormones

INTRODUCTION

Bariatric procedures generally improve dyslipidemia, sometimes substantially so. Part 1 of this two part scientific statement provided an overview of: (1) adipose tissue, cholesterol metabolism, and lipids; (2) bariatric procedures, cholesterol metabolism, and lipids; (3) endocrine factors relevant to lipid influx, synthesis, metabolism and efflux; (4) immune factors relevant to lipid influx, synthesis, metabolism, and efflux; (5) bariatric procedures, bile acid metabolism, and lipids; and (6) bariatric procedures, intestinal microbiota, and lipids, with specific emphasis on how the alterations in the microbiome by bariatric procedures influence obesity, bile acids, and inflammation, which in turn, may all affect lipid levels.

BARIATRIC PROCEDURES, INTESTINAL NUTRIENT METABOLISM, AND LIPIDS[1]

General nutritional considerations

Bariatric procedures may affect gut hormones, which are important for nutrient digestion and metabolism, which in turn, may affect lipid levels. Both the quantity and quality of foods (e.g., fats, carbohydrates, proteins, vitamins, minerals, trace elements, and other chemical compounds) can influence adipocyte and adipose tissue function, and metabolic diseases (including dyslipidemia);[1-3] and all are affected by bariatric procedures (Table 1).

BARIATRIC PROCEDURES AND NON-LIPID ATHEROSCLEROTIC CARDIOVASCULAR DISEASE RISK FACTORS

Patients with obesity are at increased for cardiovascular disease.[4] Improvement in dyslipidemia is important health benefit of bariatric procedures, helping to account for a reduction in CVD risk. However, bariatric procedures reduce multiple CVD risk factors.[5] Table 2 lists a number of CVD disorders due to adiposopathy. Table 3 describes the potential effects of bariatric procedures on ASCVD risk factors, as well as adiposopathic markers which may contribute to metabolic disease, most of which are ASCVD risk factors.

BARIATRIC PROCEDURES AND DYSLIPIDEMIA

Bariatric procedures and lipid effects

Table 4 describes the effects of various bariatric procedures on lipid parameters. Some general observations include:

1. **The greater the fat mass loss, the greater the improvement in dyslipidemia.** Table 4 details describes the major lipid parameters most often reported as improved with bariatric surgery, and include reductions in LDL cholesterol, total cholesterol, and triglyceride levels, as well as (after 6 months or so), increases in high density lipoprotein cholesterol.
2. **Data regarding the lipid effects of biliopancreatic diversion/duodenal switch is less reported than with laparoscopic gastric banding, Roux-en-Y gastric bypass, and sleeve gastrectomy**, probably because it is a less common bariatric procedure.
3. **Bariatric procedures allow for a decrease in the use of drugs for treatment of**

dyslipidemia, as well as decreased in drugs used for treatment of diabetes mellitus and blood pressure, compared to medical therapy.[6-9]

4. **High density lipoprotein cholesterol may decrease during active weight loss (particularly the first six months after bariatric surgery), and then may ultimately increase above baseline.**
5. **Data on bariatric procedures is scarce on some of the lipid parameters of most interest to lipidologists (e.g, non-high density lipoprotein cholesterol and apolipoprotein B).**

BARIATRIC PROCEDURES AND ATHEROSCLEROTIC CARDIOVASCULAR DISEASE

Bariatric procedures, cardiovascular disease risk factors, cardiovascular disease outcomes, and overall mortality

Regarding cardiovascular disease risk factors, current bariatric surgical procedures for the purpose of weight loss have demonstrated a consistent reduction in cardiovascular risk factors. Most studies of bariatric procedures report improvement in lipid levels (Table 4), as well as glucose levels, blood pressure, endothelial function, C-reactive protein, and ASCVD risk scores, such as the Framingham risk score.[5] In a systematic review of cardiovascular risk factors, bariatric surgery improved hyperlipidemia by 65%, as well as improved diabetes mellitus by 73%, and hypertension by 63%.[10] Echocardiographic data after bariatric surgery demonstrated significant improvements in left ventricular mass and function.[10]

Regarding cardiovascular events, in a meta-analysis of clinical trials comparing bariatric surgery versus non-surgical treatment, bariatric surgery patients had a statistically significant reduction in myocardial infarction (odds ratio=0.54), stroke (odds ratio=0.49), composite ASDVD events (odds ratio=0.54), and a 50% reduction in overall mortality.[11]

POST-BARIATRIC DEFICIENCIES OF VITAMINS, MINERALS, AND TRACE ELEMENTS, AND THEIR POTENTIAL LIPID EFFECTS

Post-bariatric procedure vitamin, mineral, and trace element deficiencies, and their effects upon lipid levels are described in Tables 5 and 6. It is challenging to predict how bariatric procedures may affect lipid levels in patients with post-operative micronutrient malabsorption of vitamins, minerals, and trace elements from the intestine. That is because micronutrient deficiencies are often present before bariatric procedures (e.g., vitamin D). Also, if one vitamin, mineral, or trace elements is found deficient postoperatively, then it is likely the underlying malabsorptive state is affecting other vitamins, minerals, and trace elements as well. Given that different vitamins, minerals, and trace elements may facilitate different effects upon nutrient metabolism, via different effects upon influx, efflux, anabolism, and catabolism, then the effect of multiple vitamin, mineral, and trace element deficiencies will likely have mixed biologic influences on determination net lipid blood level (some deficiencies may increase lipid levels; others may decrease lipid levels). In cases of both micro *and* macronutrient malabsorption, then diminished intestinal nutrient absorption may also substantially affect lipid blood levels. This may help explain why bariatric procedures may have varied postoperative

effects upon lipid blood levels, with lipid levels dependent on: (1) post-bariatric procedure nutritional and physical activity, (2) diminished caloric intake and other potential effects upon macronutrients, (3) other hormonal and metabolic effects of bariatric surgery, and (4) dependent upon the degree by which micronutrient deficiencies are avoided or successfully treated.

CONCLUSIONS

Bariatric procedures improve multiple cardiovascular risk factors, including glucose metabolism, blood pressure, factors related to thrombosis, kidney function, adipocyte and adipose tissue function, inflammatory markers, and vascular markers. This helps explain why bariatric procedures may reduce ASCVD risk. Bariatric procedures also improve lipid levels, which is another potential contributor to reduced ASCVD risk. Principles that apply to bariatric procedures and lipid levels include: (1) the greater the fat mass loss, the greater the improvement in lipid parameters such as triglycerides, and especially LDL cholesterol; (2) bariatric procedures allow for a decrease in the use of drug treatment for dyslipidemia; and (3) after bariatric procedures, high density lipoprotein cholesterol may transiently decrease for the first 3 – 6 months after the procedure, which is usually followed by an increase in high density lipoprotein cholesterol above the baseline value before the bariatric procedure. Finally, data is scarce regarding the effects of bariatric procedures on some of the lipid parameters of most interest to lipidologists, such as non-high density lipoprotein cholesterol, apolipoprotein B, and lipoprotein particle number and remnant lipoproteins.

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