

Effects of Short-term Medical Outpatient Weight Loss on Atherosclerotic Cardiovascular Disease Risk in Obese Patients: A Postprint Study

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Abstract

Background Obese patients have a higher risk of atherosclerotic cardiovascular disease (ASCVD), and the impact of short-term medical weight loss in a multidisciplinary obesity clinic on ASCVD risk stratification in obese patients remains to be clarified. Objective To investigate the impact of short-term medical weight loss in an outpatient setting on ASCVD risk stratification in obese patients. Methods A retrospective study was conducted on 172 obese patients who visited the multidisciplinary obesity clinic of the Endocrinology Department at Nanjing Drum Tower Hospital between July 2019 and May 2024 and completed 3 months of follow-up. General patient information, clinical indicators, and ASCVD risk (assessed using the Chinese Adult ASCVD Total Risk Assessment Flowchart) were recorded. Patients were divided into a moderate-high risk group (n=58) and a low-risk group (n=114) based on their pre-treatment ASCVD risk rating, and differences in general characteristics between the two groups were compared. Patients in the moderate-high risk group were further divided into a risk-reduction subgroup (n=36) and a risk-unchanged subgroup (n=22) according to their ASCVD risk reduction status after 3 months of treatment. Differences in various indicators and ASCVD risk before and after treatment were compared between these two subgroups, and multivariate logistic regression analysis was used to explore the influencing factors of risk reduction in obese patients with moderate-high ASCVD risk. Results Among the 172 patients, 73 were male and 99 were female, with a mean age of 32 (28, 38) years, mean body weight of 89.8 (82, 101.2) kg, and mean BMI of 31.6 (30.0, 33.9) kg/m². After 3 months of treatment, the total weight loss (TWL) was 8.8% (5.6%, 13.6%), and BMI decreased to 28.8 (27, 30.7) kg/m². Waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, ASMI, total muscle mass, VFA, systolic blood pressure, diastolic blood pressure, and glycolipid metabolism

indicators (fasting glucose, 2-hour postprandial glucose, fasting insulin, 2-hour postprandial insulin, insulin resistance index, triglycerides, cholesterol, low-density lipoprotein cholesterol, uric acid, alanine aminotransferase, and aspartate aminotransferase) all decreased compared with pre-treatment values ($P < 0.05$). Before treatment, 114 patients were in the ASCVD low-risk group and 58 patients were in the ASCVD moderate-high risk group. There were no statistically significant differences in pre-treatment BMI and body fat percentage between the moderate-high risk group and the low-risk group ($P > 0.05$), but the moderate-high risk group had higher blood glucose, more severe lipid disorders, and higher transaminase levels ($P < 0.05$). Among the 58 patients with moderate-high ASCVD risk before treatment, 36 were downgraded to low risk after 3 months of treatment (moderate-high risk reduction subgroup), while 22 remained at moderate-high risk (moderate-high risk unchanged subgroup). After 3 months of treatment, both subgroups showed decreases in body weight, BMI, waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, VFA, FINS, 2-hour postprandial insulin, insulin resistance index, triglycerides, alanine aminotransferase, and aspartate aminotransferase compared with pre-treatment values. The moderate-high risk reduction subgroup also showed decreases in systolic blood pressure, diastolic blood pressure, fasting glucose, cholesterol, and low-density lipoprotein cholesterol ($P < 0.05$). The moderate-high risk reduction subgroup showed significantly greater reductions in BMI, body fat, body fat percentage, FMI, and VFA compared with the moderate-high risk unchanged subgroup ($P < 0.05$). Multivariate logistic regression analysis revealed that BMI (OR=1.257, 95%CI=1.034~1.528, $P=0.022$) was an independent factor for risk factor reduction in obese patients with moderate-high ASCVD risk, with each 1-unit decrease in BMI associated with a 25.7% reduction in ASCVD risk. The proportion of patients with moderate-high ASCVD risk decreased after 3 months of treatment in the liraglutide group, metformin group, and non-medication group ($P < 0.05$), with no significant differences in ASCVD risk stratification or weight loss indicators between groups ($P > 0.05$). The proportion of patients with moderate-high ASCVD risk decreased in both the $28.0\text{kg}/\text{m}^2 \leq \text{BMI} < 32.5\text{kg}/\text{m}^2$ group and the $\text{BMI} \geq 32.5\text{kg}/\text{m}^2$ group after 3 months of treatment, with a greater reduction observed in the $28.0\text{kg}/\text{m}^2 \leq \text{BMI} < 32.5\text{kg}/\text{m}^2$ group compared with the $\text{BMI} \geq 32.5\text{kg}/\text{m}^2$ group ($P < 0.05$). The proportion of patients with moderate-high ASCVD risk decreased in both the female and male groups after 3 months of treatment ($P < 0.05$), with no significant difference in ASCVD risk stratification changes between the two groups ($P > 0.05$). There was no significant difference in ASCVD risk stratification changes between the 18-30 years group and the ≥ 30 years group ($P > 0.05$). *Conclusion* Short-term medical weight loss in an outpatient multidisciplinary setting can effectively reduce moderate-high ASCVD risk, this weight loss intervention is insufficient to reduce ASCVD risk stratification in the short term, and more intensive and sustained weight loss measures represent the future direction for treatment.

Full Text

Impact of Short-Term Medical Weight Loss on Atherosclerotic Cardiovascular Disease Risk in Obese Patients

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Abstract

Background: Obese patients exhibit elevated atherosclerotic cardiovascular disease (ASCVD) risk. The effect of short-term medical weight loss interventions at multidisciplinary obesity clinics on ASCVD risk stratification remains to be clarified.

Objective: To investigate the impact of short-term medical weight loss on ASCVD risk classification in obese patients.

Methods: We retrospectively analyzed 172 obese patients who completed 3-month follow-up at the obesity multidisciplinary clinic of Nanjing Drum Tower Hospital Endocrinology Department between July 2019 and May 2024. Patient demographics, clinical indicators, and ASCVD risk (assessed using the Chinese Adult ASCVD Overall Risk Assessment Flowchart) were recorded. Based on baseline ASCVD risk, patients were divided into moderate-high risk group (n=58) and low-risk group (n=114). The moderate-high risk group was further stratified into risk-reduction subgroup (n=36) and risk-stable subgroup (n=22) according to ASCVD risk changes after 3 months. Inter-group comparisons were performed, and multivariate logistic regression was used to identify factors influencing risk reduction in moderate-high risk obese patients.

Results: Among 172 patients (73 males, 99 females), mean age was 32 (28, 38) years, mean body weight 89.8 (82, 101.2) kg, and mean BMI 31.6 (30.0, 33.9) kg/m². After 3 months, total weight loss (TWL) was 8.8% (5.6%, 13.6%) and BMI decreased to 28.8 (27, 30.7) kg/m². Significant reductions were observed in waist circumference, waist-to-height ratio, body fat, body fat percentage, fat mass index (FMI), appendicular skeletal muscle mass index (ASMI), total muscle mass, visceral fat area (VFA), blood pressure, and glycolipid metabolism indicators (fasting glucose, 2-hour postprandial glucose, fasting insulin, 2-hour postprandial insulin, HOMA-IR, triglycerides, cholesterol, LDL-C, uric acid,

ALT, and AST) (all $P < 0.05$). At baseline, 114 patients were low-risk and 58 were moderate-high risk. The moderate-high risk group showed no significant difference in BMI or body fat percentage compared to the low-risk group ($P > 0.05$), but had higher glucose levels, more severe dyslipidemia, and elevated transaminases ($P < 0.05$). After treatment, 36 of 58 moderate-high risk patients transitioned to low risk (risk-reduction subgroup), while 22 remained moderate-high risk (risk-stable subgroup). Both subgroups showed reductions in weight, BMI, waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, VFA, fasting insulin, 2-hour postprandial insulin, HOMA-IR, triglycerides, ALT, and AST ($P < 0.05$). The risk-reduction subgroup additionally showed decreases in systolic/diastolic blood pressure, fasting glucose, cholesterol, and LDL-C ($P < 0.05$), with significantly greater reductions in BMI, body fat, body fat percentage, FMI, and VFA compared to the risk-stable subgroup ($P < 0.05$). Multivariate logistic regression revealed BMI (OR=1.257, 95%CI=1.034-1.528, $P=0.022$) as an independent factor for ASCVD risk reduction, with each 1-unit BMI decrease associated with 25.7% risk reduction. The proportion of moderate-high risk patients decreased in liraglutide, metformin, and non-medication groups ($P < 0.05$), with no inter-group differences in ASCVD risk or weight loss metrics ($P > 0.05$). Both BMI 28.0-32.5 kg/m² and BMI ≥ 32.5 kg/m² groups showed reduced moderate-high risk proportions, with the 28.0-32.5 kg/m² group showing greater reduction ($P < 0.05$). Both genders showed decreased moderate-high risk proportions ($P < 0.05$) without significant differences in risk changes ($P > 0.05$). Age-stratified comparisons revealed no differences in ASCVD risk changes between 18-30 years and ≥ 30 years groups ($P > 0.05$).

Conclusion: Short-term medical weight loss effectively reduces weight and fat mass while improving ASCVD risk factors in obese patients. However, for individuals with BMI ≥ 32.5 kg/m² and moderate-high ASCVD risk, this intervention is insufficient to reduce risk classification in the short term, necessitating more intensive and sustained weight loss strategies.

Keywords: Obesity; Atherosclerosis; Cardiovascular Diseases; Lifestyle; Pharmacologic Weight Loss; Lipid Management

Introduction

The 2024 Global Obesity Map projects that 46% of adults worldwide will be overweight or obese by 2025. Obesity is a major risk factor for insulin resistance, hyperlipidemia, type 2 diabetes, hypertension, hyperuricemia, and other conditions that promote the development and progression of ASCVD. In 2019 alone, over 760,000 adult deaths in China were attributed to non-communicable diseases caused by overweight/obesity, including 460,000 deaths from stroke and coronary heart disease. Weight loss of 5-15% effectively improves ASCVD risk factors.

Lifestyle interventions for weight reduction involve energy restriction, physical activity, and reduced sedentary behavior. Calorie-restricted diets (CRD) are commonly used in multidisciplinary obesity clinics, providing balanced macronutrient ratios suitable for diverse populations to facilitate weight loss, fat reduction, and improved insulin resistance. Combined aerobic and resistance exercise helps alleviate obesity and improve blood pressure, lipid profiles, and insulin resistance. In addition to lifestyle modifications, multidisciplinary obesity clinics often incorporate metformin and glucagon-like peptide-1 (GLP-1) receptor agonists as adjunctive therapies.

The obesity management model in multidisciplinary medical clinics improves ASCVD risk factors, but its impact on ASCVD risk classification remains unclear. This retrospective study analyzed data from obese patients who completed 3-month weight management at the Nanjing Drum Tower Hospital Endocrinology Obesity Multidisciplinary Clinic to elucidate the role and limitations of short-term medical weight loss in improving ASCVD risk factors and reducing risk classification.

Methods

Study Subjects We retrospectively enrolled 172 obese patients who attended the obesity multidisciplinary clinic at Nanjing Drum Tower Hospital Endocrinology Department between July 2019 and May 2024 and completed 3-month follow-up.

Inclusion Criteria: (1) Age ≥ 18 years; (2) BMI $\geq 28.0 \text{ kg/m}^2$; (3) Underwent body composition analysis (Inbody720, Biospace, Korea).

Exclusion Criteria: (1) Physical activity limitations; (2) Psychiatric disorders; (3) Malignant tumors or infectious diseases.

Data Collection General and Clinical Indicators: We collected baseline and 3-month data including sex, ASCVD risk classification, medication history, comorbidities, age, height, weight, total weight loss (TWL), BMI, waist circumference, waist-to-height ratio, heart rate, blood pressure, and biochemical parameters: fasting plasma glucose (FPG), 2-hour postprandial glucose (2hFPG), fasting insulin (FINS), 2-hour postprandial insulin (2hFINS), HOMA-IR (calculated as $\text{fasting glucose} \times \text{fasting insulin} / 22.5$), triglycerides (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), uric acid (UA), alanine aminotransferase (ALT), and aspartate aminotransferase (AST). Body composition parameters (body fat, body fat percentage, visceral fat area, appendicular skeletal muscle mass, total muscle mass) were measured using bioelectrical impedance analysis. Fat mass index (FMI) and appendicular skeletal muscle mass index (ASMI) were calculated as: $\text{FMI} = \text{fat mass (kg)} / \text{height (m)}^2$; $\text{ASMI} = \text{appendicular skeletal muscle mass (kg)} / \text{height (m)}^2$.

Intervention Protocol: The CRD provided 1,000-1,200 kcal/day with

balanced macronutrient distribution (fat 20-30%, carbohydrates 40-55%, protein 1.2-1.5 g/kg or 15-20%). Exercise recommendations included 3-5 sessions/week of moderate-intensity aerobic exercise (total 90-150 minutes) plus 2-3 sessions/week of light-to-moderate resistance training (push-ups, resistance bands) with reduced sedentary time. Pharmacotherapy included liraglutide or metformin based on physician guidance and patient preference. Effective weight loss was defined as 5-10% body weight reduction over time, with $\geq 5\%$ considered clinically meaningful.

ASCVD Risk Assessment: Using the Chinese Adult ASCVD Overall Risk Assessment Flowchart from the *Chinese Guidelines for Lipid Management (Primary Care Edition 2024)* [Figure 1: see original paper], we evaluated ASCVD risk at baseline and 3 months based on HDL-C, LDL-C, TC levels, age, sex, hypertension history, diabetes history, and smoking status.

Diagnostic Criteria: Type 2 diabetes was diagnosed by typical symptoms with random glucose ≥ 11.1 mmol/L, fasting glucose ≥ 7.0 mmol/L, 2-hour OGTT ≥ 11.1 mmol/L, or HbA1c $\geq 6.5\%$, confirmed by two abnormal tests in asymptomatic patients, excluding type 1 diabetes. Hypertension was defined as office blood pressure $\geq 140/90$ mmHg on three separate occasions without antihypertensive medication or current antihypertensive treatment. Metabolic-associated fatty liver disease required ultrasound evidence of fatty liver plus one metabolic cardiovascular risk factor. Hyperlipidemia was defined by any abnormal lipid parameter (TC ≥ 6.22 mmol/L, LDL-C ≥ 4.14 mmol/L, HDL-C < 1.04 mmol/L, TG ≥ 2.26 mmol/L) or lipid-lowering medication use. Hyperuricemia required two serum urate measurements ≥ 420 mol/L or urate-lowering therapy.

Patient Grouping: Patients were stratified by baseline ASCVD risk into low-risk (n=114) and moderate-high risk (n=58) groups. The moderate-high risk group was further divided into risk-reduction (n=36) and risk-stable (n=22) subgroups based on 3-month risk changes. To evaluate medication effects, patients were categorized into liraglutide (n=51), metformin (n=61), and non-medication (n=60) groups. Additional stratification by BMI (28.0-32.5 kg/m², n=105; ≥ 32.5 kg/m², n=67), sex (female n=73, male n=99), and age (18-30 years n=58, ≥ 30 years n=114) was performed to control confounding variables.

Statistical Analysis: SPSS 26.0 was used for analysis. Normally distributed data were expressed as mean \pm SD, compared using independent t-tests (inter-group) and paired t-tests (intra-group). Non-normally distributed data were presented as median (P25, P75), analyzed using non-parametric tests (inter-group) and paired rank-sum tests (intra-group). Categorical data were compared using χ^2 tests. Multivariate logistic regression identified factors influencing ASCVD risk reduction. ANOVA compared multiple groups, with covariance analysis adjusting for baseline differences when necessary. Statistical significance was set at $P < 0.05$.

Results

Baseline Characteristics and Overall Treatment Effects Among 172 patients (73 males, 99 females), mean age was 32 (28, 38) years, mean weight 89.8 (82, 101.2) kg, and mean BMI 31.6 (30.0, 33.9) kg/m². Comorbidities included type 2 diabetes (26.2%), hypertension (37.8%), fatty liver disease (58.7%), hyperlipidemia (81.4%), and hyperuricemia (45.3%). Some patients received metformin, liraglutide, or antihypertensive/lipid-lowering medications during follow-up.

After 3 months, TWL was 8.8% (5.6%, 13.6%), BMI decreased to 28.8 (27.0, 30.7) kg/m², and significant reductions occurred in waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, ASMI, total muscle mass, VFA, blood pressure, and all glycolipid metabolism parameters ($P<0.05$).

Baseline Comparison: Low-Risk vs. Moderate-High Risk ASCVD At baseline, 114 patients were classified as low-risk and 58 as moderate-high risk. The moderate-high risk group showed no significant differences in BMI, body fat percentage, waist circumference, waist-to-height ratio, FMI, VFA, ASMI, total muscle mass, heart rate, blood pressure, FINS, or UA compared to the low-risk group ($P>0.05$). However, the moderate-high risk group had significantly higher FPG, 2hFPG, 2hFINS, HOMA-IR, TG, TC, LDL-C, ALT, and AST, and lower HDL-C ($P<0.05$).

Changes in Moderate-High Risk Patients After 3 Months Among 58 moderate-high risk patients at baseline, 36 transitioned to low risk (risk-reduction subgroup) and 22 remained moderate-high risk (risk-stable subgroup) after 3 months. At baseline, the risk-reduction subgroup had lower BMI, body fat, body fat percentage, FMI, VFA, and FINS, and higher HDL-C compared to the risk-stable subgroup ($P<0.05$), with no other significant differences.

After 3 months, both subgroups showed significant reductions in weight, BMI, waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, VFA, FINS, 2hFINS, HOMA-IR, TG, ALT, and AST ($P<0.05$). The risk-reduction subgroup additionally showed decreases in systolic/diastolic blood pressure, FPG, TC, and LDL-C. The risk-reduction subgroup demonstrated significantly greater reductions in BMI, body fat, body fat percentage, FMI, and VFA compared to the risk-stable subgroup ($P<0.05$).

Logistic Regression Analysis of Risk Reduction Factors Univariate logistic regression identified BMI, body fat, body fat percentage, FMI, and VFA as influencing factors ($P<0.05$). Multivariate analysis revealed BMI as an independent predictor (OR=1.257, 95%CI=1.034-1.528, $P=0.022$), with each 1-unit BMI decrease associated with 25.7% ASCVD risk reduction.

Medication Group Comparisons To exclude medication effects, patients were stratified into liraglutide (n=51), metformin (n=61), and non-medication

(n=60) groups. All three groups showed decreased proportions of moderate-high risk patients after 3 months ($P<0.05$), with significant improvements in weight, BMI, waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, VFA, and ASMI ($P<0.05$). No significant differences were found in ASCVD risk changes or weight loss metrics among the three groups ($P>0.05$).

Stratified Analyses by BMI, Sex, and Age **BMI Stratification:** The 28.0-32.5 kg/m² group (n=105) had lower baseline weight, BMI, waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, VFA, ASMI, and total muscle mass compared to the BMI $\geq 32.5\text{kg/m}^2$ group (n=67) ($P<0.05$), with no baseline ASCVD risk difference. After 3 months, both groups showed reduced moderate-high risk proportions and improvements in all anthropometric and body composition parameters ($P<0.05$). The 28.0-32.5 kg/m² group demonstrated greater reductions in moderate-high risk proportion and most parameters compared to the BMI $\geq 32.5\text{kg/m}^2$ group ($P<0.05$).

Sex Stratification: Females (n=73) had lower baseline weight, BMI, waist circumference, ASMI, and total muscle mass, but higher body fat percentage, FMI, and VFA compared to males (n=99) ($P<0.05$), with no baseline ASCVD risk difference. Both sexes showed decreased moderate-high risk proportions and improvements in most parameters after 3 months ($P<0.05$). Females demonstrated greater reductions in weight, waist circumference, ASMI, and total muscle mass, while males showed greater reductions in body fat percentage, FMI, and VFA ($P<0.05$). No sex differences were observed in ASCVD risk changes.

Age Stratification: The 18-30 years group (n=58) had lower baseline weight, BMI, waist circumference, body fat, VFA, ASMI, and total muscle mass compared to the ≥ 30 years group (n=114) ($P<0.05$), with no baseline ASCVD risk difference. Both groups showed improvements in weight, BMI, waist circumference, waist-to-height ratio, body fat, body fat percentage, FMI, and VFA after 3 months ($P<0.05$). The ≥ 30 years group showed decreased moderate-high risk proportion ($P<0.05$), but no age-related differences were observed in ASCVD risk changes.

Discussion

Current medical weight management in obesity clinics, led by endocrinology and nutrition departments, emphasizes lifestyle modification and pharmacotherapy. This study found that 3-month weight loss intervention achieved 8.8% TWL, meeting the 3-6 month target of 5-15% weight reduction, with concurrent improvements in blood pressure and glycolipid metabolism. At baseline, moderate-high risk patients had similar BMI and body fat percentage but more severe metabolic disturbances and liver dysfunction compared to low-risk patients, indicating that metabolic complications rather than adiposity alone determined risk stratification.

Among moderate-high risk patients, those who transitioned to low risk had lower baseline BMI, body fat, and visceral adiposity, and achieved greater reductions in these parameters after treatment. Multivariate analysis identified BMI as an independent predictor, with each 1-unit decrease reducing ASCVD risk by 25.7%. Chinese guidelines recommend medical weight management for BMI 28.0-32.5 kg/m², and metabolic surgery for BMI $\geq 32.5 \text{ kg/m}^2$ with comorbidities if medical therapy fails. Our findings suggest that patients with BMI $\geq 32.5 \text{ kg/m}^2$ and moderate-high ASCVD risk who remained at risk after treatment had insufficient weight loss (BMI decreased from 33.9 to 30.9 kg/m²), highlighting the need for more intensive strategies.

Stratified analyses revealed that patients with lower baseline BMI (28.0-32.5 kg/m²) achieved greater risk reduction and more pronounced improvements in anthropometric parameters compared to those with BMI $\geq 32.5 \text{ kg/m}^2$. No differences were observed in ASCVD risk changes across medication, sex, or age groups, further supporting the importance of intensive weight reduction, particularly for BMI $\geq 32.5 \text{ kg/m}^2$ individuals with moderate-high ASCVD risk. Newer agents such as semaglutide 2.4 mg/week and tirzepatide 15 mg/week, which achieve 16.9% and 22.5% weight loss respectively, may better address the needs of this high-risk population by producing greater fat mass and visceral fat reductions while improving ASCVD risk factors.

Our previous research comparing metabolic surgery outcomes showed that achieving normal BMI (18.5-24.0 kg/m²) provided greater resolution of fatty liver disease, hypertension, and hyperuricemia compared to persistent obesity, suggesting BMI normalization as an optimal target. Blood pressure and lipid levels are critical components of ASCVD risk assessment, and concurrent use of antihypertensive and statin therapy can rapidly improve these parameters. However, only a minority of our patients received these medications. Endocrinology-led weight management should prioritize ASCVD outcomes, combining weight loss strategies with lipid-lowering and antihypertensive therapy to accelerate risk reduction.

This study has limitations including its single-center retrospective design, relatively small sample size, short follow-up duration, and lack of quantitative dietary and exercise data. Future multicenter collaborations or big data platforms with larger cohorts, prospective randomized controlled trials with untreated controls, and comprehensive control of confounders (socioeconomic status, dietary habits, medication use) are needed to validate these findings and inform personalized treatment strategies.

Conclusion

Short-term multidisciplinary medical weight management effectively reduces weight and fat mass while improving ASCVD risk factors in obese patients. However, for individuals with BMI $\geq 32.5 \text{ kg/m}^2$ and moderate-high ASCVD risk, this approach is insufficient to reduce risk classification in the short

term. More potent weight loss medications and, when necessary, metabolic surgery represent future treatment options for this population, with concurrent lipid-lowering therapy facilitating ASCVD risk reduction.

Author Contributions

Xiang Xinyue: data collection, analysis, and initial manuscript drafting. Zhang Bingqing: figure preparation and statistical assistance. Ouyang Yuqin: data quality control and manuscript assistance. Tang Wenjuan: manuscript revision. Feng Wenhuan: study conception, design, final content revision, and overall responsibility.

Conflict of Interest: None declared.

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