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Changes in predicted cardiovascular disease risk after biliopancreatic diversion surgery in severely obese patients

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ABSTRACT

Objective. To determine the impact of biliopancreatic diversion with duodenal switch (BPD-DS) surgery on cardiovascular risk profile and predicted cardiovascular risk in severely obese patients.

Materials/Methods. We compared 1-year follow-up anthropometric and metabolic profiles in severely obese who underwent BPD-DS (n = 73) with controls (severely obese without surgery) (n = 33). The 10-year predicted risk for coronary heart disease (CHD) was estimated using the Framingham risk-tool. We assigned 10-year and lifetime predicted risks to stratify subjects into 3 groups: 1) high short-term predicted risk (≥10% 10-year risk or diagnosed diabetes), 2) low short-term (<10% 10-year risk)/low lifetime predicted risk or 3) low short-term/high lifetime predicted risk.

Results. During the follow-up period, body weight and body mass index decreased markedly in the surgical group (−52.1 ± 1.9 kg and −19.0 ± 0.6 kg/m^2 respectively, $p < 0.001$) vs. (−0.7 ± 1.0 kg and −0.3 ± 0.4 kg/m^2, $p = 0.51$). Weight loss in the surgical group was associated with a reduction in HbA_{1C} (6.2% vs. 5.1%), HOMA-IR (61.5 vs. 9.3), all lipoprotein levels, as well as blood pressure ($p < 0.001$). The 10-year CHD predicted risk decreased by 43% in women and 33% in men, whereas the estimated CHD risk in the non surgical group did not change. Before surgery, none of the women and only 18% of men showed low short-term/low lifetime predicted risk, whereas a significant proportion of subjects had high short-term predicted risk (36% in women and 12% in men). Following surgery, 52% of women and 55% of men have a low short-term/low lifetime predicted risk.

Conclusions. These results highlight the cardiovascular benefits of BPD-DS and suggest a positive impact on predicted CHD risk in severely obese patients. Long-term studies are needed to confirm our results and to ascertain the effects on CHD risk estimates after BPD-DS surgery.

Abbreviations: BPD-DS, Biliopancreatic diversion with duodenal switch; CHD, Coronary heart disease; NIH, National Institute of Health; SOS, Swedish Obese Subjects group; BMI, Body mass index; HOMA-IR, HOMA insulin resistance model; ATP III, Adult Treatment Panel III; Hs-CRP, High sensitive C-reactive protein; CVD, Cardiovascular disease.

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1. Introduction

Obesity is prevalent and is associated with significant cardiovascular morbidity and mortality which are exacerbated by the obesity state itself [1–3]. Systemic hypertension, insulin resistance, type 2 diabetes, dyslipidemia and systemic inflammation, are all contributors to the higher cardiovascular risk profile associated with obesity [4]. Furthermore, it is well known that morbidity and mortality rates increase proportionally to the degree of obesity in men and women [1].

Bariatric surgery is an interesting therapeutic option for those with severe obesity [1,5–7]. In the 1991 consensus, the National Institute of Health (NIH) reported that bariatric surgical therapy be proposed to those patients with a body mass index (BMI) >40 or >35 kg/m^2 with serious obesity-related comorbidities such as systemic hypertension, diabetes and obstructive sleep apnea. When indicated, bariatric surgery intervention leads to a significant decrease in excess weight and improvement in comorbidities that can be maintained over time [1,8]. In addition, a recent analysis of the Swedish Obese Subjects (SOS) group has shown that bariatric surgery led to a 30% reduction in the incidence of cardiovascular events in obese patients compared with those who received usual care and a 50% reduction in cardiovascular deaths following almost 15 years of follow-up [9]. Several bariatric surgery procedures are available for the management of severely obese patients. Surgical techniques differ in terms of morbidity and mortality rate, magnitude of weight loss, weight loss maintenance over time and rate of resolution of comorbidities [5]. A variation of the biliopancreatic diversion (BPD), the biliopancreatic diversion with duodenal switch (BPD-DS) surgery, has been associated with an acceptable risk/benefit ratio in terms of complications, in addition to achieving greater weight loss in many studies [5,10]. Of note, resolution of diabetes seems to be more prevalent following the predominantly malabsorptive procedures such as BPD-DS in contrast to the purely restrictive procedures.

Cardiovascular risk assessment tools have been widely used for risk stratification among asymptomatic individuals clinically free of coronary heart disease (CHD). Global risk score engine aids primary prevention efforts by early identification of higher-risk patients who may benefit from aggressive lifestyle changes and pharmacological therapy [11,12]. The Framingham risk score has been extensively validated [13]. Recently, the predicted lifetime CHD risk algorithm has been proposed as a more appropriate assessment of future CHD risk and has been suggested as a supplement to the Framingham short-term CHD risk estimation [14].

The impact of bariatric surgery on estimated CHD risk events is still poorly defined. The first objective of our study was to evaluate metabolic and cardiovascular improvements after BPD-DS surgery in severely obese patients in comparison to controls. The comparative severely obese group presents a unique opportunity to demonstrate the potential benefit effect of BPD-DS surgery in reducing CHD risk factors and estimated short-term and lifelong CHD risk. We used cardiovascular risk stratification tools such as the Framingham short-term risk score and the predicted lifetime cardiovascular risk to test the predicted cardiovascular risk reduction in severely obese patients after BPD-DS surgery. To our knowledge, our study is the first to estimate the lifetime risk for developing CHD in severely obese patients following BPD-DS surgery.

2. Methods

2.1. Subjects

We included 73 randomly selected men and women, 18 years of age or older, with an indication for bariatric surgery BMI ≥40 kg/m^2 or ≥35 kg/m^2 with associated comorbidities). Patients were recruited through the bariatric surgery clinic of our institution. Severely obese controls with the same surgical indications were randomly recruited from the waiting list for bariatric surgery to match patients in the BPD-DS group for age and gender. Both groups had comparable preoperative characteristics. All patients included in the control group were managed medically and investigated as the surgical group during the follow-up period. No specific intervention was performed in this group but these patients received, as the surgical group, usual dietary or lifestyle recommendations by health care professionals associated to the bariatric surgery clinic in order to maintain/lose weight while on the waiting list. In that sense, all individuals were encouraged to adopt better healthy eating habits to lower their CHD risk: (1) moderate energy (caloric) intake to maintain or even decrease body weight during the pre-operative period; (2) emphasize a diet rich in vegetables, fruit, whole-grain cereals, and poly-unsaturated and monounsaturated oils, including ω-3 fatty acids particularly from fish; (3) avoid trans fats, limit saturated and total fats to <7% and <30% of daily total energy (caloric) intake, respectively; (4) increase daily fibre intake to >30 g; (5) limit cholesterol intake to 200 mg daily for individuals with dyslipidemia or at increased CVD risk. Furthermore, we recommend to all participants to increase their energy expenditure via increment in aerobic physical activity. Subjects who had previously undergone bariatric surgery, those with incomplete follow-up data or those with a pacemaker were excluded (as per manufacturer's safety indication, a patient with a pacemaker cannot undergo electrical bioimpedance assessment). All patients were informed regarding the risks and benefits of BPD-DS surgery and provided a written informed consent. The experimental protocol was approved by the Quebec Heart and Lung Institute/Laval University Research Ethics Committees.

2.2. Study design

All patients underwent a complete medical evaluation before and during follow-up (baseline, 6 months and 12 months), including medication use, a complete history and physical examination by a cardiologist, anthropometrics and clinical measurements, and blood sampling for further laboratory tests.

2.3. Cardiovascular risk factor and CHD risk definitions

Coronary artery disease was defined as self-reported myocardial infarction or previous coronary revascularisation. Systemic hypertension was defined as a blood pressure ≥140/90 mmHg and/or use of antihypertensive medication whereas