REVIEW

Use of Metabolic Surgery for the Treatment of Type 2 Diabetes

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ABSTRACT

Diabetes currently affects more than 220 million people worldwide. This number has increased from 171 million, reported in 2000, and the World Health Organization (WHO) projects this number will reach 366 million by 2030. One of the most significant contributors to the increased prevalence of diabetes is the epidemic of obesity. According to the International Obesity Task Force and the 2002 WHO World Health Report, ~58% of diabetes globally can be attributed to a body mass index (BMI) >21 kg/m². Increasing use of bariatric surgery for the treatment of patients with type 2 diabetes and morbid obesity has been associated with significant improvement and even remission of diabetes in post-surgical patients. This, in turn, has led to significant research into the physiological pathways involved. The current guidelines for bariatric surgery limit its use to patients with diabetes or comorbidities whose BMI is ≥35 kg/m²; however, recent studies suggest these guidelines may need to be adjusted to include patients with type 2 diabetes who have a lower BMI.

KEYWORDS: bariatric surgery, body mass index, obesity, type 2 diabetes

RÉSUMÉ

À l'heure actuelle, plus de 220 millions de personnes dans le monde souffrent de diabète. Ce nombre était de 171 millions en 2000 et, selon l'Organisation mondiale de la santé (OMS), il sera de 366 millions d'ici 2030. L'épidémie d'obésité est un des facteurs contribuant le plus à l'augmentation de la prévalence du diabète. Selon l'International Obesity Task Force (IOTF) et le *Rapport sur la santé dans le monde 2002* de l'OMS, environ 58 % des cas de diabète dans le monde sont attribuables à un indice de masse corporelle (IMC) de plus de 21 kg/m²[2]. L'augmentation du recours à la chirurgie bariatrique pour le traitement des patients atteints de diabète de type 2 et d'obésité morbide a été associée à une amélioration significative, voire à une rémission, du diabète chez les patients opérés, ce qui a mené à des recherches considérables sur les voies physiologiques de cet effet. Les lignes directrices actuelles limitent le recours à la chirurgie bariatrique aux patients qui présentent des troubles comorbides et dont l'IMC est de 35 kg/m² ou plus, mais des études récentes donnent à penser que ces lignes directrices pourraient devoir être modifiées pour inclure les patients atteints de diabète de type 2 ayant un IMC inférieur.

MOTS CLÉS : chirurgie bariatrique, indice de masse corporelle, obésité, diabète de type 2

DIABETES AND OBESITY

The relationship between diabetes and obesity is indisputable; the increasing rate of obesity is at parallel with the increasing rate of diabetes (1,2). Overweight is generally classified as body mass index (BMI) ≥25.0 kg/m², while obesity is defined as BMI ≥30.0 kg/m² and morbid obesity is characterized as BMI ≥40.0 kg/m². Approximately 1.4 billion adults were classified as overweight in 2005, with 400 million of them defined as obese (3). These figures are estimated to rise to 2.3 billion and 700 million, respectively, by 2015 (3). Diabetes currently affects >2 million Canadians, and type 2 diabetes affects approximately 90% of Canadians diagnosed with diabetes (4). The increasing prevalence of diabetes is mainly due to the escalating rate of obesity and, to a lesser degree, the declining mortality of people with diabetes (5).

At birth, the lifetime risk of developing diabetes is 1 in 3, but studies have shown that the correlation between weight and BMI can modify this risk (6). In a recent trial, Narayan and colleagues explored the impact of BMI on the lifetime risk of diabetes (6). The lifetime risk was estimated by age, race, sex and BMI, and was assessed using a Markov model to estimate rates of diabetes, which incorporated data from the National Health Interview Survey, the United States (US) Census Bureau and 2 previous studies (6). Narayan's study concluded that individuals with a BMI ≥30.0 kg/m² have a considerably higher lifetime risk of diabetes, a higher risk of having the disease for more years, and are at risk of excess life-years lost to diabetes, compared to individuals with a lower BMI (6). The study further concluded that overweight and obese people at younger ages have a substantially higher

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lifetime risk of diabetes associated with increased BMI (Figures 1, 2 and 3), while the impact of BMI on diabetes and disease duration decreases with age (6).

The complex correlation of type 2 diabetes and obesity confers an increased risk of developing many complications, including microvascular disorders such as neuropathy, retinopathy and nephropathy, and macrovascular disorders such as cardiovascular disease and stroke. Many comorbidities increase with obesity and overweight, i.e. hypertension, osteoarthritis, gallstones, dyslipidemia and musculoskeletal problems (7). Field and colleagues conducted a study to predict the impact of weight and BMI on the risk of developing chronic diseases (7). Participants with BMI ≥36.0 kg/m² were 20-times more likely to develop diabetes than their same-sex peers with a lower BMI (18.5–24.9 kg/m²) (7). The incidence of diabetes, gallstones, hypertension, heart disease and colon cancer increased with degree of overweight in both men and women (7).

Epidemiological evidence confirms that the risk of developing diabetes and other comorbidities is related to weight gain. It has been demonstrated that a modest weight loss of 5% to 10% of body weight produces significant reductions in blood glucose (BG) levels, lipids and blood pressure (5). However, an excess weight loss of ~20% is required to eliminate most comorbidities (8). Conservative methods, including diet, exercise and medication, have not resulted in a sustainable weight loss of >7.0% at 1 year (8).

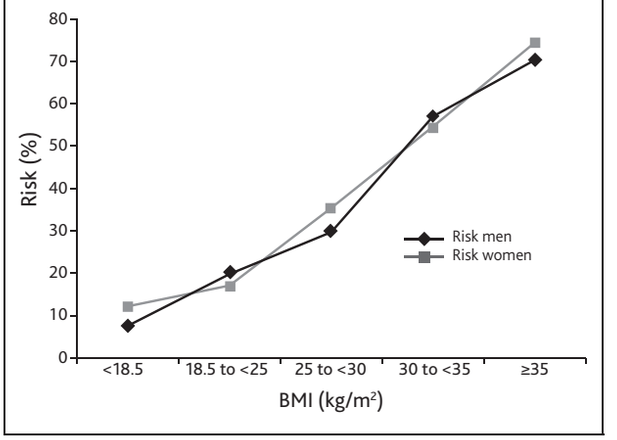
Medications currently available in Canada to treat obesity have also been shown to be relatively ineffective. Recent clinical trials revealed that 2 of the most frequently prescribed medications for long-term weight loss—orlistat and sibutramine—have poor compliance and resulted in modest weight losses of 2.7 and 4.3 kg, respectively, after 1 year (9).

Reducing body weight is often difficult for individuals with diabetes. Most weight loss programs are unsuccessful in helping patients sustain significant weight loss, and nutritional and lifestyle modifications often produce limited results. As Buchwald noted: "Unfortunately, diet therapy, with and without support organizations, is relatively ineffective in treating obesity in the long term. There are no truly effective pharmaceutical agents to treat obesity" (10). Moreover, many antihyperglycemic agents cause weight gain, thereby producing a recurring cycle that ultimately complicates weight loss for people with diabetes, that is medication is needed to maintain glucose homeostasis, but the associated weight gain results in a secondary increase in insulin resistance, subsequently necessitating an increase in medication.

PHYSIOLOGY OF OBESITY

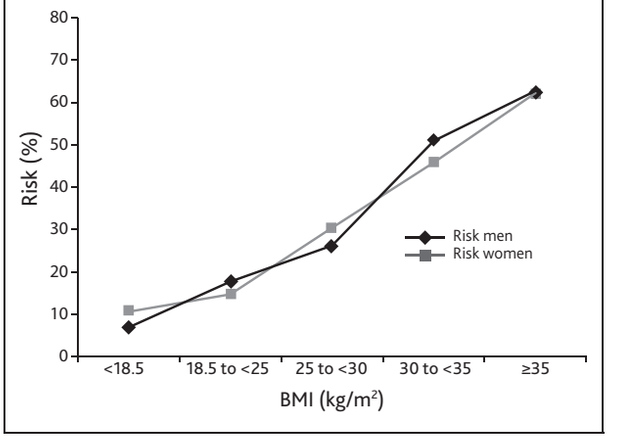
It is generally believed that the ability to gain, lose or maintain body weight is controlled by a balance between

Figure 1. Lifetime risk of developing diabetes by BMI: baseline age, 18 years (adapted with permission from 6)



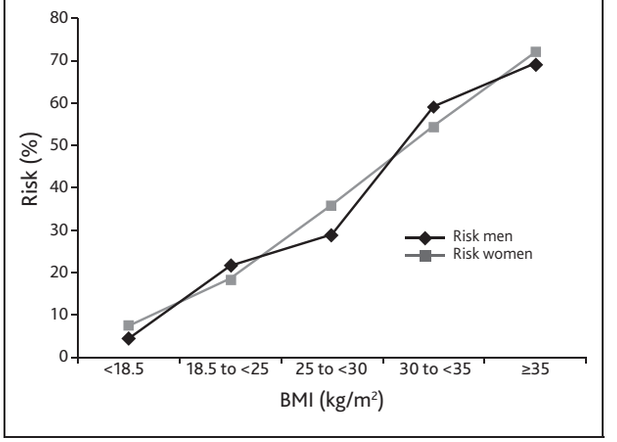
BMI = body mass index

Figure 2. Lifetime risk of developing diabetes by BMI: baseline age, 45 years (adapted with permission from 6)



BMI = body mass index

Figure 3. Lifetime risk of developing diabetes by BMI: baseline age, 65 years (adapted with permission from 6)



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