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Cost-effectiveness of bariatric surgery for severely obese adults with diabetes

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The term "evidence-based medicine" was first coined by Sackett and colleagues as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."[1] The key to practising evidence-based medicine is applying the best current knowledge to decisions in individual patients. Medical knowledge is continually and rapidly expanding. For clinicians to practise evidence-based medicine, they must have the skills to read and interpret the medical literature so that they can determine the validity, reliability, credibility and utility of individual articles. These skills are known as critical appraisal skills, and they require some knowledge of biostatistics, clinical epidemiology, decision analysis and economics, and clinical knowledge.

Evidence Based Reviews in Surgery (EBRS) is a program jointly sponsored by the Canadian Association of General Surgeons (CAGS) and the American College of Surgeons (ACS) and is supported by an educational grant from ETHICON and ETHICON ENDO-SURGERY, both units of Johnson & Johnson Medical Products, a division of Johnson & Johnson and ETHICON Inc. and ETHICON ENDO-SURGERY Inc., divisions of Johnson & Johnson Inc. The primary objective of EBRS is to help practising surgeons improve their critical appraisal skills. During the academic year, 8 clinical articles are chosen for review and discussion. They are selected for their clinical relevance to general surgeons and because they cover a spectrum of issues important to surgeons, including causation or risk factors for disease, natural history or prognosis of disease, how to quantify disease, diagnostic tests, early diagnosis and the effectiveness of treatment. A methodological article guides the reader in critical appraisal of the clinical article. Methodological and clinical reviews of the article are performed by experts in the relevant areas and posted on the EBRS website, where they are archived indefinitely. In addition, a listserv allows participants to discuss the monthly article. Surgeons who participate in the monthly packages can obtain Royal College of Physicians and Surgeons of Canada Maintenance of Certification credits and/or continuing medical education credits for the current article only by reading the monthly articles, participating in the listserv discussion, reading the methodological and clinical reviews and completing the monthly online evaluation and multiple choice questions.

We hope readers will find EBRS useful in improving their critical appraisal skills and in keeping abreast of new developments in general surgery. Four reviews are published in condensed versions in the *Canadian Journal of Surgery* and 4 are published in the *Journal of the American College of Surgeons*. For further information about EBRS, please refer to the CAGS or ACS websites. Questions and comments can be directed to the program administrator, Marg McKenzie, at mmckenzie@mtsinai.on.ca.

Reference

1. Evidence-Based Medicine Working Group. Evidence-based medicine. *JAMA* 1992;268: 2420-5.

SELECTED ARTICLE

Horerger TJ, Zhang P, Segel JE, et al. Cost-effectiveness of bariatric surgery for severely obese adults with diabetes. *Diabetes Care* 2010;33:1933–39.

Abstract

Objective: To analyze the cost-effectiveness of bariatric surgery in severely obese adults who have diabetes. **Base case:** Patients with body mass index (BMI) ≥ 35 who have diabetes. **Methods:** The Centre for Disease Control (CDC)-RTI Diabetes Cost-Effectiveness Model, which is a Markov simulation model of disease progression and cost-effectiveness for type 2 diabetes, was expanded to consider the effects of bariatric surgery. **Interventions considered:** Gastric bypass and gastric banding compared with usual diabetes care. **Outcomes considered:** Diabetes-related and surgical complications, diabetes remission and relapse rates, deaths, costs and quality of life. **Results:** Bariatric surgery increased quality-adjusted life years (QALYs) and increased costs. Bypass surgery had cost-effectiveness ratios of $7 000 per QALY and $12 000 per QALY for severely obese patients with newly diagnosed and established diabetes, respectively. Gastric banding had cost-effectiveness ratios of $11 000 per QALY and $13 000 per QALY, respectively. In sensitivity analyses, the cost-effectiveness ratios were most affected by assumptions about the direct gain in quality of life and by BMI reduction following surgery. **Conclusion:** The analysis indicates that gastric bypass and gastric banding are cost-effective methods of reducing mortality and diabetes-related complications in severely obese adults with diabetes.

Commentary

Bariatric surgery has a well-established role in the management of obesity. Procedures such as gastric banding, gastric bypass and gastric sleeve resection have been shown to result in sustained weight loss where medical management has failed. There are approximately 2 million people in Canada and 20 million people in the United States who have type 2 diabetes. Of these, approximately 80%–90% are obese. Bariatric surgery has been shown to reverse type 2 diabetes by a mechanism that is unclear in a substantial number of patients. This effect can be independent of weight loss.

The study by Horerger and colleagues attempts to measure the cost-effectiveness of bariatric surgery compared with medical management of diabetes. It takes an established model of cost-effectiveness simulating diabetes progression that was developed by the Centers for Disease Control (CDC) and adds the costs and outcomes associated with bariatric surgery. This model measures costs and outcomes in patients with type 2 diabetes from diagnosis to death and simulates the development of diabetic complications along 3 microvascular pathways (nephropathy, neuropathy and retinopathy) and 2 macrovascular pathways (coronary heart disease and stroke). The important outcomes related to surgery are the probability of remission of disease (complete and partial), the probability of relapse and the probability of complications related to the surgery. Reported costs are in 2005 US dollars and are discounted at a rate of 3% per year, as is usually done in an economic analysis. Costs associated with usual diabetic care were derived from the UK Prospective Diabetes study.[1]

The study population is diabetic patients with a BMI of 35 or more. This is the group that qualifies for bariatric surgery under current National Institutes of Health guidelines.

The authors performed a comprehensive analysis of medical costs using U.S. data that include the upfront costs of surgery as well as the costs associated with subsequent years of care and the need for revision surgery (e.g., cholecystectomy, pannectomy). They compare the costs of gastric bypass and gastric banding, which are the 2 most common procedures performed in the United States, although sleeve gastrectomy is being performed more commonly now. Unfortunately, the exact derivation of the costs is only available in an online appendix to the paper and cannot be easily reviewed. It is not clear if the authors studied costs from a societal perspective and included time off work and patient costs.

The authors modelled the outcomes of surgery based on 2 meta-analyses that included 982 published studies. It should be noted, however, that only 5% of the publications were randomized controlled trials (RCTs). The authors determined the rate of remission of diabetes in patients with new onset (56.7%–80.3%) or established diabetes (40%) for both gastric banding and gastric bypass. They were also able to model the complications of surgery with data derived from the same studies. Bariatric surgery had cost-effectiveness ratios ranging between $7 000 and $13 000 per QALY. Patients with new onset diabetes gained more QALYs after surgery than those with established diabetes, and they gained more QALYs from bypass surgery than gastric banding but had a higher surgical cost. To put these costs in context, it is generally considered that interventions with a cost of less than $50 000 per QALY are cost-effective.[2]

Most importantly in this type of study, the authors went on to perform sensitivity analyses. They varied the possible outcomes of surgery from one-half to 2 times the observed rates to see if this affected the cost-effectiveness of surgery. They found that the incremental cost-effectiveness of surgery did not change much unless they varied the QALY improvement or the weight loss associated with surgery. Finding an operation to be cost-effective even when the outcomes vary widely strongly suggests that the findings are robust.

Unfortunately the authors did not find surgery to be cheaper overall than medical management. However, they modelled only the costs of diabetic care and did not factor in potential cost savings for other conditions related to weight loss. For example, decreasing blood pressure or decreasing the need for joint replacement could definitely reduce costs for surgical patients.

Bariatric surgery has become an important option in the management of diabetes and should be considered in obese patients with this disease. The study by Horerger and colleagues provides a thorough analysis of the costs and benefits of gastric bypass and gastric banding and finds the procedures to be cost-effective. In addition 3 recent RCTs of bariatric surgery versus medical management in obese patients with type 2 diabetes have been published.[3–5] The one by Dixon and colleagues[3] showed that gastric banding is superior to medical management at 2 years. Mingrone and colleagues[4] compared gastric bypass and biliopancreatic diversion to medical management. No patients in the medically managed arm had remission of diabetes at 2 years, while 75% of the patients who underwent gastric bypass and 95% of those who underwent biliopancreatic diversion were in remission.[4] Schauer and colleagues[5] compared gastric bypass and gastric sleeve to intensive medical management. At 1 year, 12% of the medically managed patients, 42% in the gastric bypass group and 37% in the gastric sleeve group had a hemoglobin A1C of 6.0% or less.[5] Thus, all of the commonly performed bariatric procedures have been shown to be effective in the short term for the management of type 2 diabetes.

What remains to be further defined is the most appropriate time to intervene surgically in patients with type 2 diabetes (at what BMI, at what illness duration, and at what age?). Also to be defined is the most appropriate procedure (gastric band, gastric bypass, biliopancreatic diversion, or gastric sleeve). While this will take some time to assess, it is clear that bariatric surgery should be discussed with patients as an option for treatment of type 2 diabetes and obesity. The results of the study by Horerger and colleagues should encourage surgeons, physicians, insurers and policy makers to improve access to bariatric/metabolic surgery for morbidly obese patients with type 2 diabetes.

The importance and relevance of this cost-effectiveness study lies in the way in which it promotes a unique opportunity for general surgeons to play a pivotal role in the definitive management of diabetes. Departments of surgery will have to prepare for a further increase in demand for a procedure with already long wait lists and limited access.

Competing interests: None declared.

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