Bariatric & Metabolic Surgery:

A New Paradigm for an Old Disease

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Today's Discussion

- The Diabesity Epidemic
- Bariatric Surgery – Impressive Results
- Is Diabetes a Surgical Disease?
- Mechanism of Diabetes Control
- Implications for Future Therapies
- Bariatric Surgery at a Center of Excellence

What's In a Name?

Diabesity – An Epidemic

- Diabetes Mellitus affects more than 150 million people worldwide
- Expected to ***double*** by 2025
- Recent data suggest the number of obese adults is now greater than the number of overweight adults

Obesity: The Health Crisis in America

- Surgeon General, physicians and the American public all agree
- 66% of American adults overweight or obese
- 34% are obese
- 5% are severely obese
- Over 22% of WI adults are obese

Trust for America's Health Facts 2004, http://www.cdc.gov/pcd/issues/2005/jan/04_0087.html

Healthcare Costs of Obesity

- Obesity has been shown to be associated with:
  - 36% increase in inpatient and outpatient spending
  - 77% increase in medication use
- Highest-cost drivers are those of managing the co-morbidities associated with obesity
  - 85% of the total cost of treating type 2 diabetes
  - 45% of the cost of treating hypertension

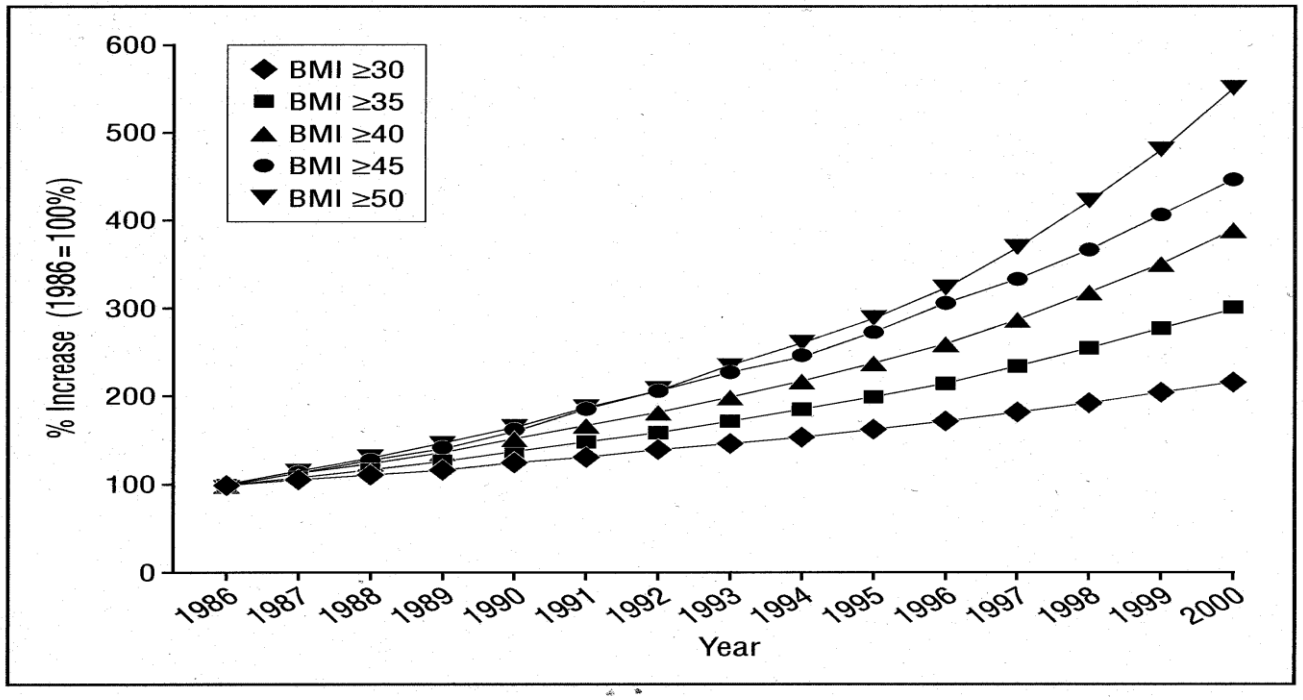
Roland Sturm, PhD, *Health Affairs*, March/April 2002

	Class	BMI (kg/m^2)	Risk
Underweight		<18.5	Increased
Normal		18.5-24.9	Normal
Overweight		25.0-29.9	Increased
Obesity Class	I	30.0-34.9	High
Severe Obesity	II	35.0-39.9	Very High
Morbid Obesity	III	≥40	Extremely High
Super Obesity	IV	≥50	Extremely High
Super Super Obesity	V	≥60	Extremely High

Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults—The Evidence Report. *Obes Res* 1998;6(suppl 2). Extreme often referred to as Clinically Severe Obesity or Morbid Obesity.

Morbid Obesity

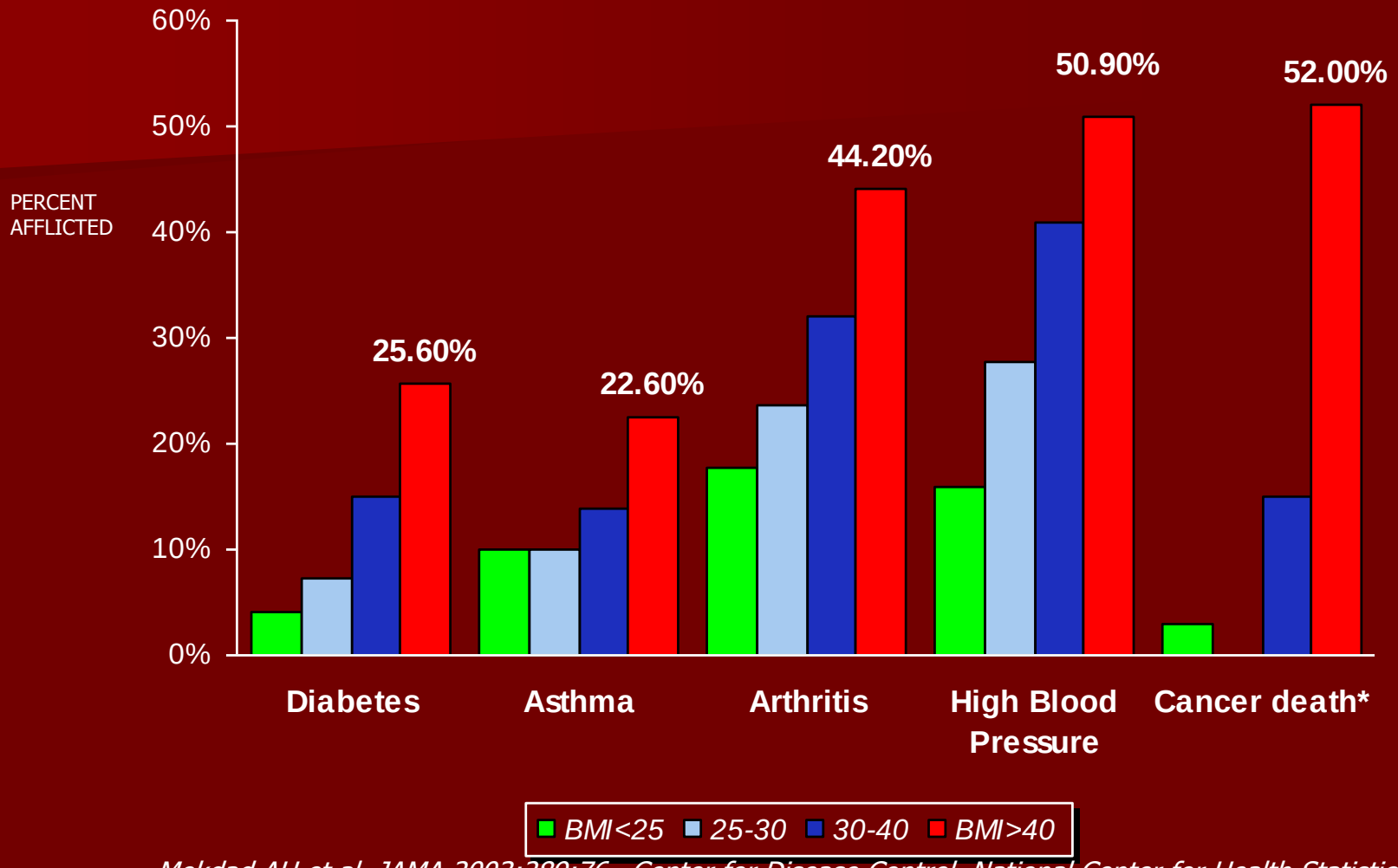
An "epidemic within an epidemic"



10 million Americans are morbidly obese

Trust for America's Health Facts 2004 http://www.cdc.gov/pcd/issues/2005/jan/04_0087.htm

Prevalence of Significant Morbidities



Mokdad AH et al. JAMA 2003;289:76 Center for Disease Control, National Center for Health Statistics

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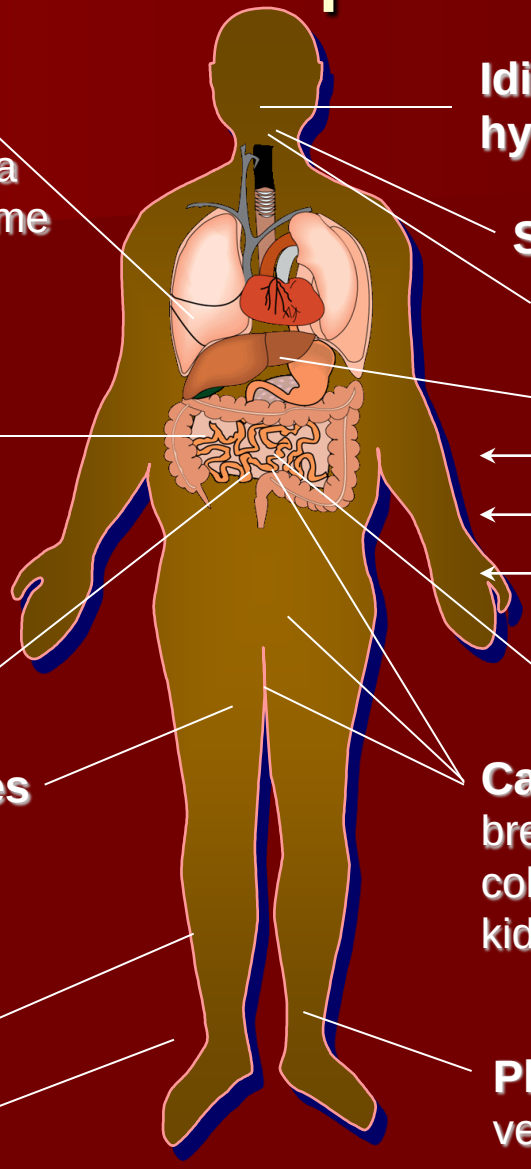
Physiological Impact of Obesity



Pulmonary disease
abnormal function
obstructive sleep apnea
hypoventilation syndrome

Nonalcoholic fatty liver disease
steatosis
steatohepatitis
cirrhosis

Gall bladder disease

Gynecologic abnormalities
abnormal menses
infertility
polycystic ovarian syndrome

Osteoarthritis

Skin

Idiopathic intracranial hypertension

Stroke

Cataracts

Coronary heart disease

Diabetes

Dyslipidemia

Hypertension

Severe pancreatitis

Cancer
breast, uterus, cervix
colon, esophagus, pancreas
kidney, prostate

Phlebitis
venous stasis

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"Diabesity"

- A direct relationship exists between the obesity epidemic and an emerging epidemic of diabetes
- In the past two decades, the rate of diabetes has doubled in America
- Diabetes increases the risk for heart disease 6 fold and multiplies the risk of stroke by 4
- Diabetes is the most costly disease in America, consuming 1 out of every 7 dollars

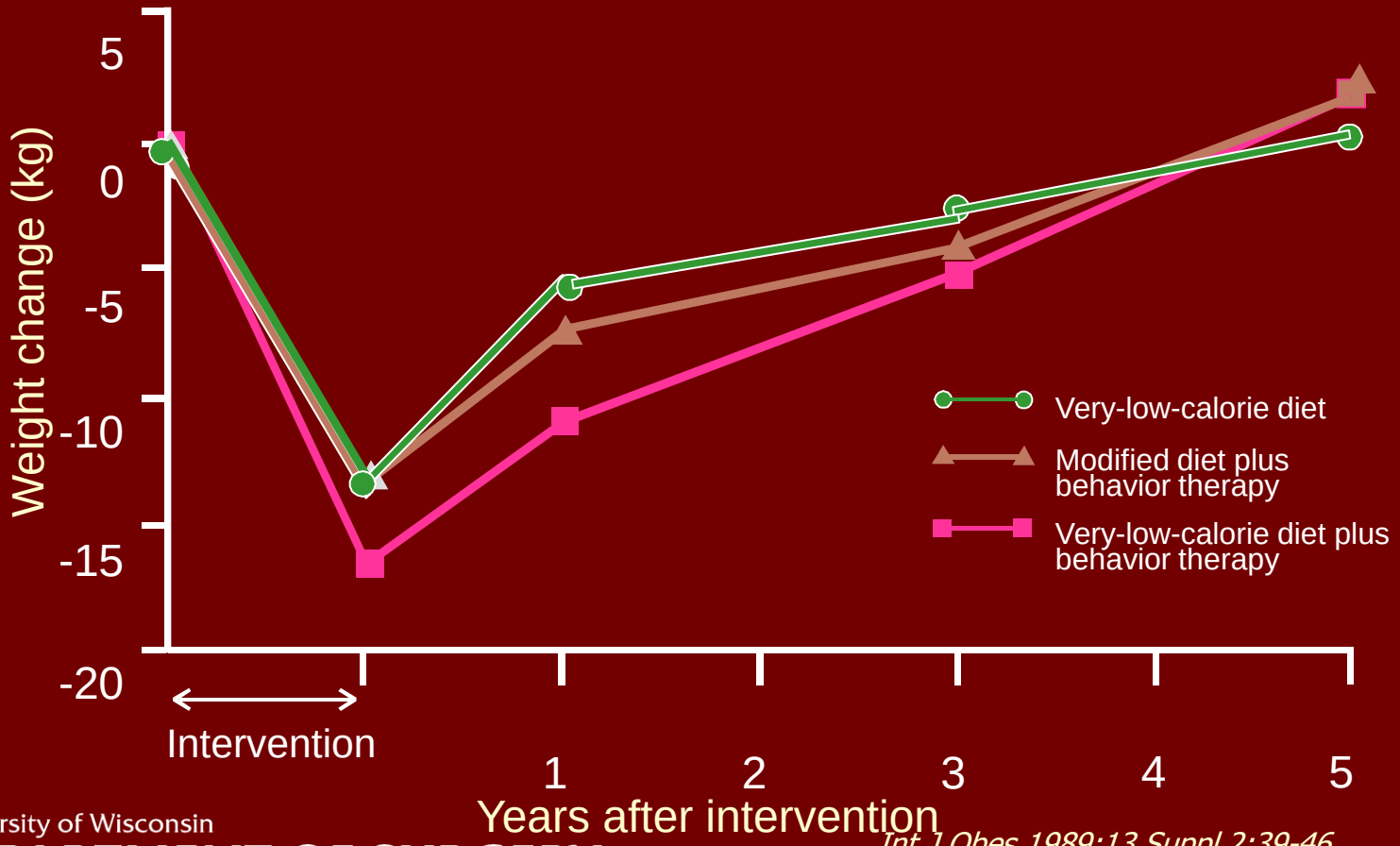
Why Bariatric Surgery?

Nonsurgical treatment for those suffering from morbid obesity produce a failure rate near 100%

National Institutes of Health. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults—The Evidence Report [published correction appears in *Obes Res.* 1998;6:464]. *Obes Res.* 1998;6(suppl 2):51S-209S.

Jain A. What Works for Obesity? A summary of the research behind obesity intervention. London, England: BMJ Publishing Group; April 2004

Very Low Calorie Diet (VLCD) +/- Behavior Modification



Int J Obes 1989;13 Suppl 2:39-46.

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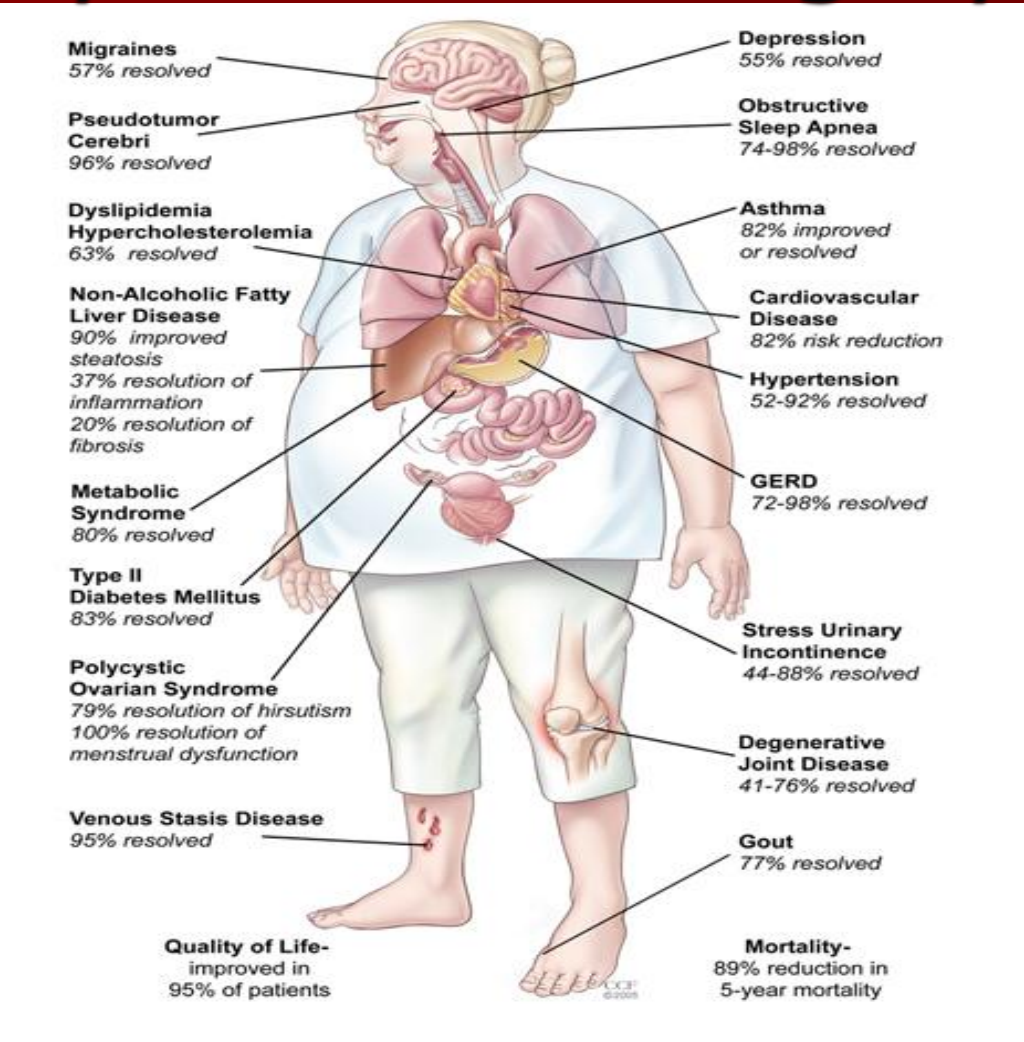
Why Bariatric Surgery?



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NEJM Summary of Results

"Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects," by Sjöström et al.

- Sjöström, et al conducted a prospective, controlled study comparing severely obese patients desiring bariatric surgery with equally obese patients not desiring surgery.
- The study concluded bariatric surgery for severe obesity is associated with long-term weight loss and decreased overall mortality.
- A 29% reduction in death was found after an average follow up of 10.9 years.

Sjöström L, Narbro K, Sjöström CD, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. N Engl J Med 2007; 357:741-52.

NEJM Summary of Results

"Long Term Mortality after Gastric Bypass Surgery."

- Adams, et al conducted a retrospective cohort study examining information obtained from driver's license records that were matched to patients who had undergone gastric bypass-surgery.

- The study concluded that long-term mortality for gastric-bypass patients was significantly reduced.
  - Overall deaths were reduced by 40%
  - Deaths from diabetes were reduced by 92%
  - Deaths from heart disease were reduced by 56%
  - Deaths from cancer were reduced by 60%

Adams TD, Gress RE, Smith SC, et al. Long-term mortality after gastric bypass surgery. N Engl J Med 2007:357:753-61.

Diabetes:

A New Paradigm?

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Initial Clues – Walter Pories, MD

- Early 1980's – initial work on RNY
- Diabetic patients relieved of insulin requirements within days of surgery
- 95% followup over *16* years – 83% of diabetics, 99% with impaired glucose tolerance maintained euglycemia (n=165)
- Second cohort (n=76) – scheduled for, but cancelled surgery; well matched
  - RNY mortality – 1% per year
  - No surgery mortality – 4.5% per year ($p<0.0001$)

Confirmation - Schauer

- 1160 gastric bypasses
- 240 diabetic patients
- 83% returned to euglycemia
- Those that didn't respond – older with longer duration of disease

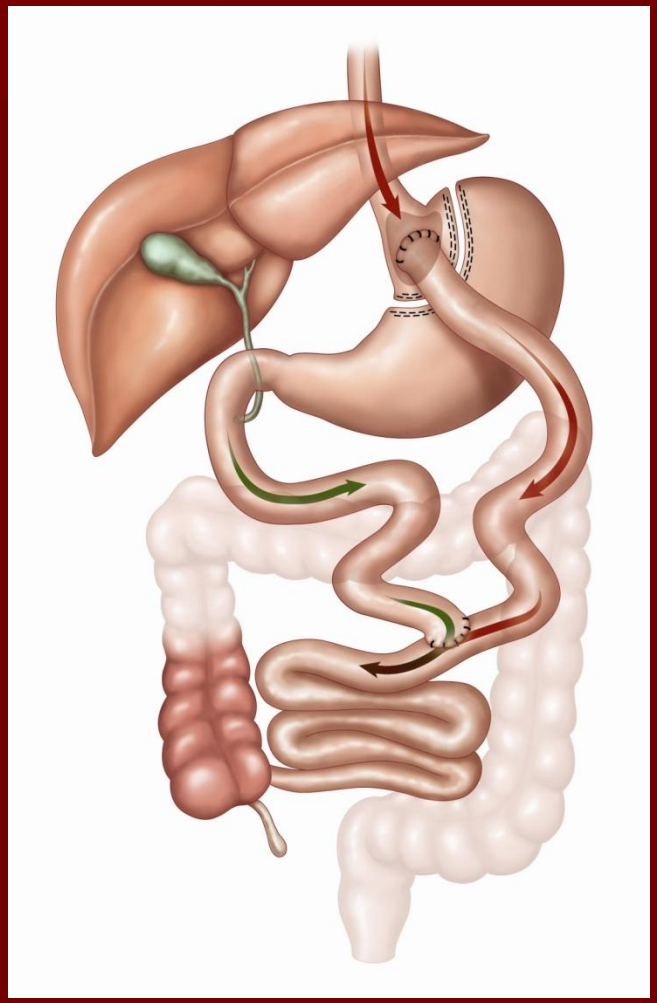
Bariatric Surgery Treats Type 2 Diabetes

- Type 2 diabetes resolves in more than 83% of morbidly obese patients
- Many patients see resolution or improvement of their diabetes even before they start shedding significant amounts of weight
- 75% discontinued insulin completely
  - 20% leave the hospital insulin free
- Average monthly insulin therapy cost dropped 91%
- Average per-patient medication cost savings was $443 per year

Buchwald, et al, JAMA 2004

Laparoscopic Gastric Bypass

- Long track record
- Gold Standard
- General anesthesia
- 5 or 6 small incisions
- 1-2 day hospital stay
- Restriction and malabsorption



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Lap Gastric Bypass

Major Risks of Gastric Bypass Surgery

Early (<30 days)	UW Health (515)	Arch Surg 2003
Leak	1.4% (7)	2.0%
Major bleeding	1.9% (10)	1.9%
Wound infection	4.2% (22)	3.0%
Pulmonary embolism	0.2% (1)	0.4%
Death	0.2% (1)	0.3%

Arch Surg 2003;138:957-961 and UW data as of June 30, 2009

Major Risks of Gastric Bypass Surgery

Late (>30 days)	UW Health (477)	Arch Surg 2003
Stenosis	3.4%* (8)	4.7%
Internal hernia	2.9% (14)	2.9%

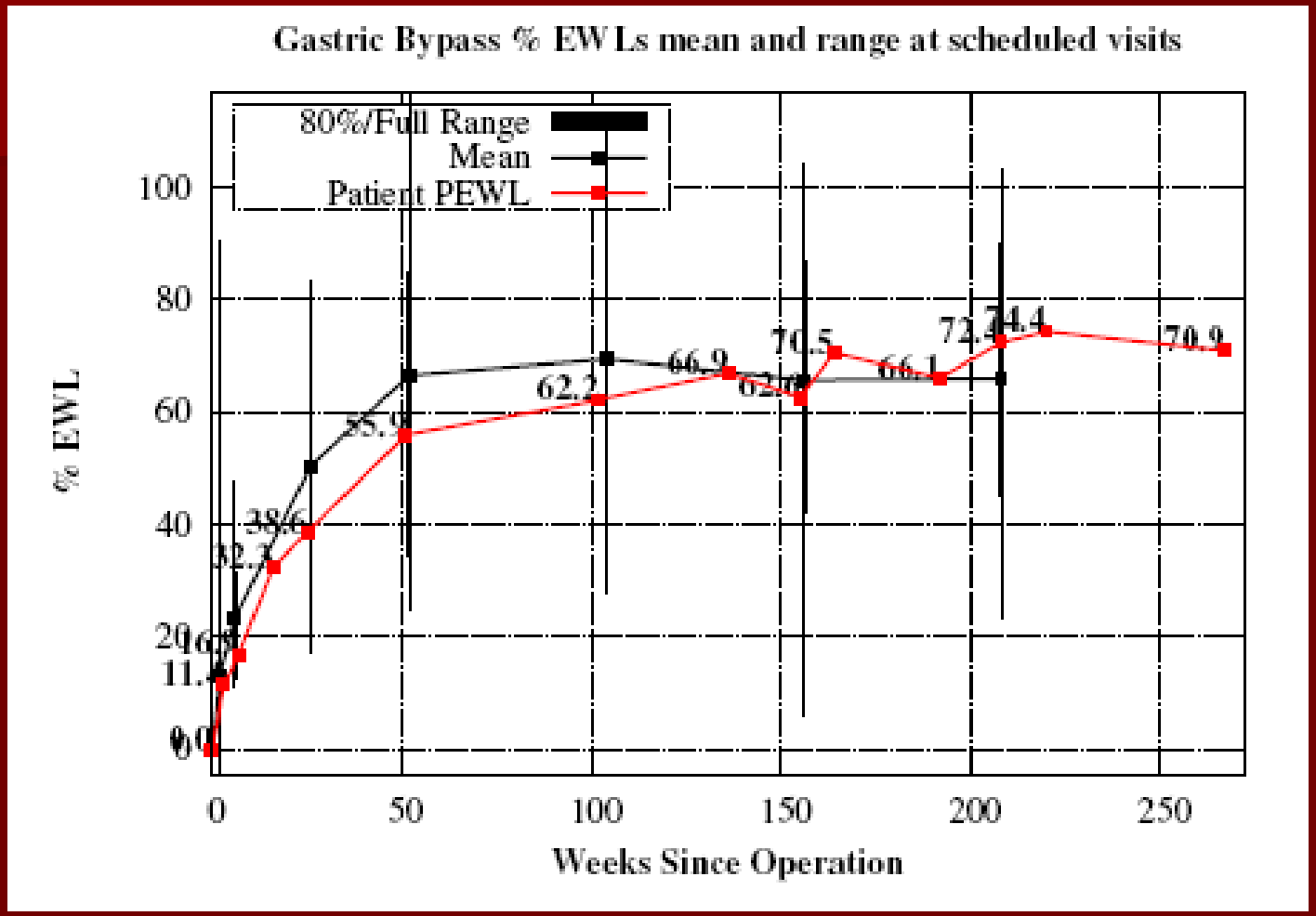
*Results are for laparoscopic procedures since 2005 (n=274)

Arch Surg 2003;138:957-961 and UW data as of June 30, 2009

Laparoscopic Gastric Bypass Weight Loss

- Rapid weight loss (6-7pounds/week)
- Lose weight for first 12 months
- Ultimately lose 60-70% of excess weight

Gastric Bypass Weight Loss



Remission? How? Why?

- Weight Loss?
  - Doesn't explain frequent immediate remission
- Food Restriction?
  - Diabetic patients do not respond to surgical stress with euglycemia
  - Most develop hyperglycemia and increased requirements for insulin
  - Diabetic patients generally return to previous levels of antidiabetic therapy once they resume usual diets

How? Why?

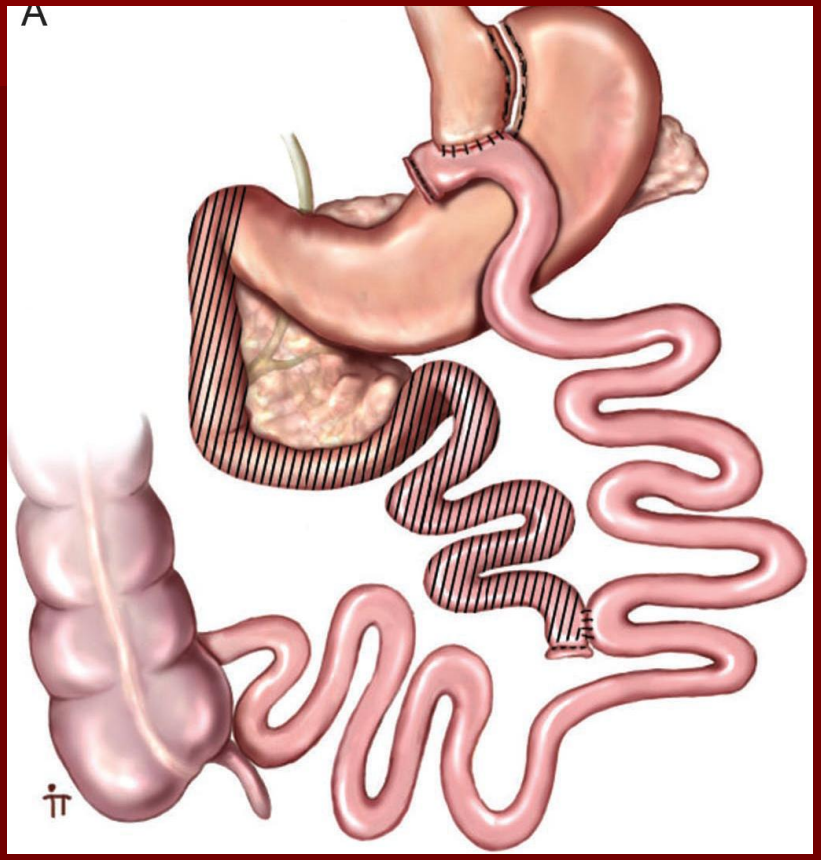
- Obese women with T2DM before and 1 month after gastric bypass or after diet-induced equivalent weight loss
- Total GLP-1 levels after oral glucose increased six times
- Incretin effect (difference in insulin levels in response to oral and IV glucose loads) increased five times
- Conclusion: Data suggests the greater GLP-1 and GIP release and improvement in incretin effect are related *not* to weight loss, but rather to the surgical procedure.

Laferre B, et al. J Clin Endocrinol Metab. Apr 2008

A Better Explanation?

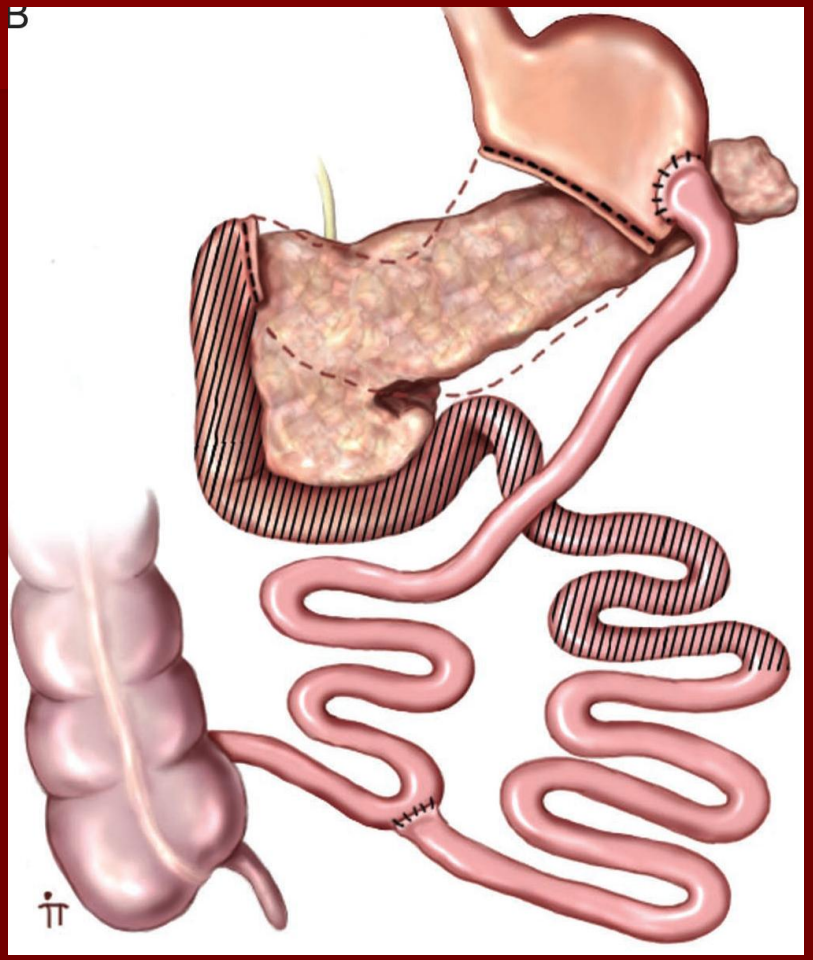
The Gut

Roux-en-Y Gastric Bypass



Rubino, et al

Biliopancreatic Diversion

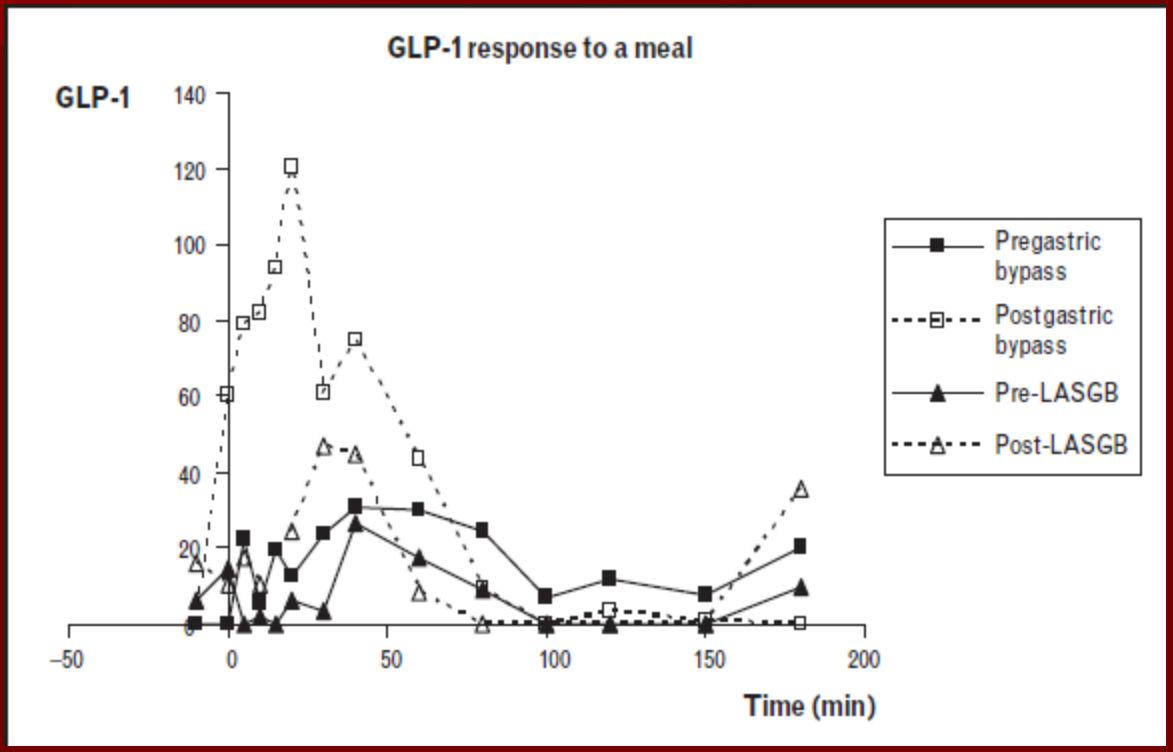


Rubino, et al

RNY and BPD

- Foodstuffs are diverted from duodenum and proximal jejunum
- Several peptides in this part of the bowel are involved in governing beta cell function both in physiologic and diabetic states
- The changes in entero-insular axis might explain antidiabetic effects.
- THEN, similar results should also occur in nonobese individuals

Enhanced Incretin Effect



Perugini, et al. "Remission of Type 2 DM with Bariatric Surgery: review of mechanisms of action and concept of reversibility.: Current Opinion in Endocrinology, Diabetes and Obesity. 2011, 18:119-128.

Study Design

- Hypothesis: The control of diabetes is NOT a secondary outcome of the control of obesity, but rather, a direct effect of duodenal-jejunal exclusion. Therefore, similar results should occur in non-obese individuals.

Goto –Kakizaki (GK) Rats

- Most widely used animal model of *nonobese* type 2 diabetes
- Stomach – preserving gastrojejunal bypass leaving intact original stomach volume
  - Avoid influence from mechanical reduction of food intake and/or hormonal effects secondary to bypass of the distal stomach.

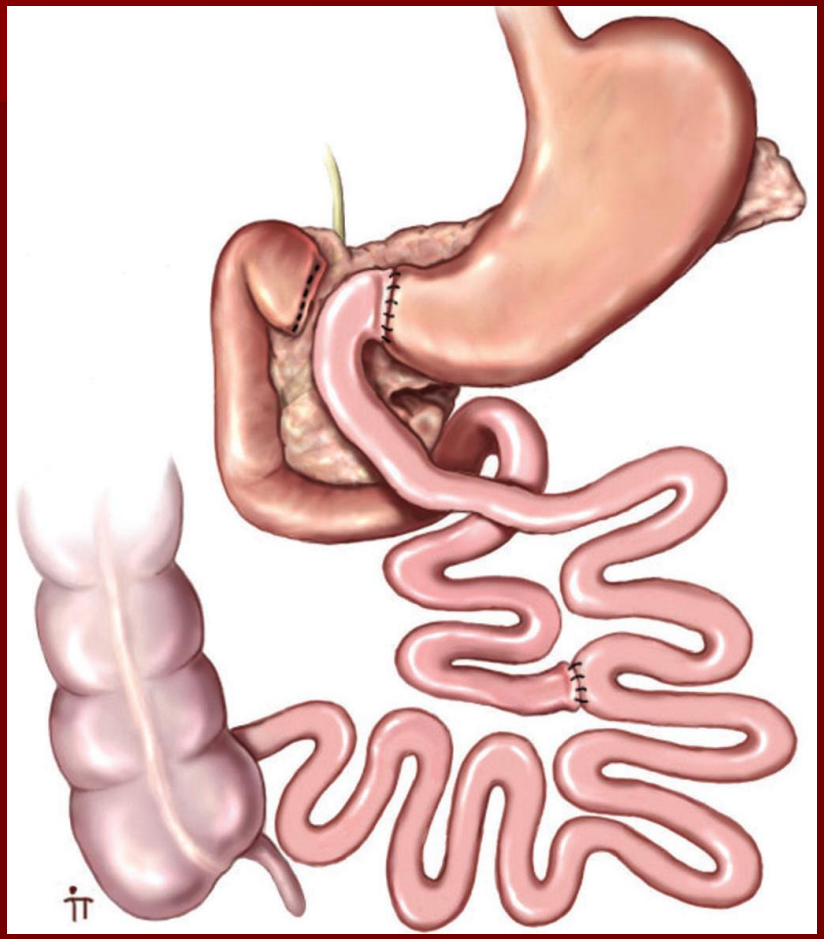
Study Protocols

- Randomized rats underwent
  - Gastrojejunal Bypass, or
  - Sham operation, or
  - Food restriction, or
  - No intervention (control)

Measurements

- Oral glucose tolerance
- Fasting plasma insulin levels
- Glucose-dependent-insulinotropic peptide (GIP)
- Plasma lipids
- Insulin tolerance tests

Gastrojejunal Bypass



Rubino, et al

Findings

- Duodenal-jejunal exclusion reduces fasting glycemia and improves both glucose tolerance and insulin action in a non-obese animal model
- The control of diabetes is not dependent on resolution of *obesity-related* abnormalities
- The effect on glucose metabolism seems to be a direct effect of duodenal-jejunal exclusion and not secondary to weight loss
- Decrease intake is excluded as a cause as GJB and sham operated rats consumed the same amount

These findings support the hypothesis that the control of diabetes observed in morbidly obese individuals by means of RNY gastric bypass or biliopancreatic diversion is caused by a direct antidiabetic effect of the operation.

Molecular Mechanism of Action Remains Elusive

At Least Two Distinct Mechanisms Involved:

- Increased incretin response in early postoperative period which leads to augmentation of insulin secretion from beta cell mass (independent of weight loss)
- Improved peripheral insulin sensitivity (correlates with degree of weight loss)

Implications for Therapy?

- Surgery for Diabetes in non-obese patients??
- Current NIH guidelines (from 1991 Consensus Conference) recommend consideration of bariatric surgery in patients with diabetes and a BMI $\geq$35kg/m2
- The possible correlation with animal studies suggest need for clinical trials of duodenal-jejunal exclusion procedures in non-obese diabetic humans

"Single Shot Treatment"

- Longterm glycemic control not impaired by patient noncompliance as it does for diets, exercise or complex medical regimens
  - Though weight regain may reverse benefit
- Could reduce the overall economic burden on health care systems by avoiding the costs of life-long medical therapies as tight glucose control is associated with increased cost of intensive medical management

Risk / Benefit

- RYGB overall mortality 0.2%
- RYGB early complications 3-15%
- Need long-term supervision and vitamin and nutrient supplementation

Executive Summary: Standards of Medical Care in Diabetes—2009

Current Criteria for the Diagnosis of Diabetes

- Fasting plasma glucose (FPG) ≥126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h
- Symptoms of hyperglycemia and a casual (random) plasma glucose ≥200 mg/dl (11.1 mmol/l). Casual (random) is defined as any time of day without regard to time since last meal. The classic symptoms of hyperglycemia include polyuria, polydipsia, and unexplained weight loss.
- 2-h plasma glucose ≥200 mg/dl (11.1 mmol/l) during an oral glucose tolerance test (OGTT). The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.

Testing for Pre-Diabetes and Diabetes in Asymptomatic Patients

- Testing to detect pre-diabetes and type 2 diabetes in asymptomatic people should be considered in adults of any age who are overweight or obese (BMI ≥25 kg/m^2) and who have one or more additional risk factors for diabetes). In those without these risk factors, testing should begin at age 45 years. (B)
- If tests are normal, repeat testing should be carried out at least at 3-year intervals. (E)
- To test for pre-diabetes or diabetes, an FPG test or 2-h OGTT (75-g glucose load) or both are appropriate. (B)
- An OGTT may be considered in patients with impaired fasting glucose (IFG) to better define the risk of diabetes. (E)
- In those identified with pre-diabetes, identify and, if appropriate, treat other cardiovascular disease (CVD) risk factors. (B)

Testing for Type 2 Diabetes in Children

- Test children who are overweight (BMI >85th percentile for age and sex, weight for height >85th percentile, or weight >120% of ideal for height) and have any two of the following risk factors:
  - Family history of type 2 diabetes in first- or second-degree relative
  - Race/ethnicity of Native American, African American, Latino, Asian American, or Pacific Islander
  - Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small-for-gestational-age birth weight)
  - Maternal history of diabetes or gestational diabetes mellitus (GDM) during the child's gestation (E)
  - Testing should begin at age 10 years or at onset of puberty, if puberty occurs at a younger age, and be repeated every 3 years. (E)
  - FPG is the preferred test. (E)

Detection and Diagnosis of GDM

- Screen for GDM using risk factor analysis and, if appropriate, use of an OGTT. (C)
- Women with GDM should be screened for diabetes 6–12 weeks postpartum and should be followed up with subsequent screening for the development of diabetes or pre-diabetes. (E)

Prevention/Delay of Type 2 Diabetes

- Patients with impaired glucose tolerance (A) or IFG (E) should be referred to an effective ongoing support program for weight loss of 5–10% of body weight and increasing physical activity to at least 150 min per week of moderate activity such as walking.
- Follow-up counseling appears to be important for success. (B)
- Based on potential cost savings of diabetes prevention, such counseling should be covered by third-party payors. (E)
- In addition to lifestyle counseling, metformin may be considered in those who are at very high risk for developing diabetes (combined IFG and IGT plus other risk factors such as A1C >6%, hypertension, low HDL cholesterol, elevated triglycerides, or family history of diabetes in a first-degree relative) and who are obese and under 60 years of age. (E)
- Monitoring for the development of diabetes in those with pre-diabetes should be performed every year. (E).

Glucose Monitoring

- Self-monitoring of blood glucose (SMBG) should be carried out three or more times daily for patients using multiple insulin injections or insulin pump therapy. (A)
- For patients using less frequent insulin injections, noninsulin therapies, or medical nutrition therapy (MNT) and physical activity alone, SMBG may be useful as a guide to the success of therapy. (E)
- To achieve postprandial glucose targets, postprandial SMBG may be appropriate. (E)
- When prescribing SMBG, ensure that patients receive initial instruction in, and routine follow-up evaluation of, SMBG technique and their ability to use data to adjust therapy. (E)
- Continuous glucose monitoring (CGM) in conjunction with intensive insulin regimens can be a useful tool to lower A1C in selected adults (aged ≥25 years) with type 1 diabetes (A).
- Although evidence for A1C lowering is less strong in children, teens, and younger adults, CGM may be helpful in these groups. Success correlates with adherence to ongoing use of the device. (C)
- CGM may be a supplemental tool to SMBG in those with hypoglycemia unawareness and/or frequent hypoglycemic episodes. (E)

DOI: 10.2337/dc09-S006

Executive Summary

A1C

- Perform the A1C test at least two times a year in patients who are meeting treatment goals (and who have stable glycemic control). (E)
- Perform the A1C test quarterly in patients whose therapy has changed or who are not meeting glycemic goals. (E)
- Use of point-of-care testing for A1C allows for timely decisions on therapy changes, when needed. (E)

Glycemic Goals in Adults

- Lowering A1C to below or around 7% has been shown to reduce microvascular and neuropathic complications of type 1 and type 2 diabetes. Therefore, for microvascular disease prevention, the A1C goal for nonpregnant adults in general is <7%. (A)
- In type 1 and type 2 diabetes, randomized controlled trials of intensive versus standard glycemic control have not shown a significant reduction in CVD outcomes during the randomized portion of the trials. Long-term follow-up of the Diabetes Control and Complications Trial (DCCT) and UK Prospective Diabetes Study (UKPDS) cohorts suggests that treatment to A1C targets below or around 7% in the years soon after the diagnosis of diabetes is associated with long-term reduction in risk of macrovascular disease. Until more evidence becomes available, the general goal of <7% appears reasonable for many adults for macrovascular risk reduction. (B)
- Subgroup analyses of clinical trials such as the DCCT and UKPDS and the microvascular evidence from the ADVANCE (Action in Diabetes and Vascular Disease: Preterax and Diamicron MR Controlled Evaluation) trial suggest a small but incremental benefit in microvascular outcomes with A1C values closer to normal. Therefore, for selected individual patients, providers might reasonably suggest even lower A1C goals than the general goal of <7%, if this can be achieved without significant hypoglycemia or other adverse effects of treatment. Such patients might include those with short duration of diabetes, long life expectancy, and no significant CVD. (B)
- Conversely, less stringent A1C goals than the general goal of <7% may be appropriate for patients with a history of severe hypoglycemia, limited life expectancy, advanced microvascular or macrovascular complications, and extensive comorbid conditions and those with longstanding diabetes in whom the general goal is difficult to attain despite diabetes self-management education, appropriate glucose monitoring, and effective doses of multiple glucose-lowering agents including insulin. (C)

Medical Nutrition Therapy (MNT)
General recommendations

- Individuals who have pre-diabetes or diabetes should receive individualized MNT as needed to achieve treatment goals, preferably provided by a registered dietitian familiar with the components of diabetes MNT. (B)
- MNT should be covered by insurance and other payors. (E)

Energy balance, overweight, and obesity

- In overweight and obese insulin-resistant individuals, modest weight loss has been shown to reduce insulin resistance. Thus, weight loss is recommended for all overweight or obese individuals who have or are at risk for diabetes. (A)
- For weight loss, either low-carbohydrate or low-fat calorie-restricted diets may be effective in the short-term (up to 1 year) (A).
- For patients on low-carbohydrate diets, monitor lipid profiles, renal function, and protein intake (in those with nephropathy) and adjust hypoglycemic therapy as needed. (E)
- Physical activity and behavior modification are important components of weight loss programs and are most helpful in maintenance of weight loss. (B)

Primary prevention of diabetes

- Among individuals at high risk for developing type 2 diabetes, structured programs that emphasize lifestyle changes and include moderate weight loss (7% body weight) and regular physical activity (150 min/week), with dietary strategies including reduced calories and reduced intake of dietary fat, can reduce the risk for developing diabetes and are therefore recommended. (A)
- Individuals at high risk for type 2 diabetes should be encouraged to achieve the U.S. Department of Agriculture recommendation for dietary fiber (14 g fiber/1,000 kcal) and foods containing whole grains (one-half of grain intake). (B)

Dietary fat intake in diabetes management

- Saturated fat intake should be <7% of total calories. (A)
- Intake of *trans* fat should be minimized. (B)

Carbohydrate intake in diabetes management

- Monitoring carbohydrate, whether by carbohydrate counting, exchanges, or experience-based estimation, remains a key strategy in achieving glycemic control. (A)
- For individuals with diabetes, the use of the glycemic index and glycemic load may provide a modest additional benefit for glycemic control over that observed when total carbohydrate is considered alone. (B)

Other nutrition recommendations

- Sugar alcohols and nonnutritive sweeteners are safe when consumed within the acceptable daily intake levels established by the Food and Drug Administration. (A)
- If adults with diabetes choose to use alcohol, daily intake should be limited to a moderate amount (one drink per day or less for adult women and two drinks per day or less for adult men). (E)
- Routine supplementation with antioxidants, such as vitamins E and C and carotene, is not advised because of lack of evidence of efficacy and concern related to long-term safety. (A)
- Benefit from chromium supplementation in people with diabetes or obesity has not been conclusively demonstrated and, therefore, cannot be recommended. (E)

Bariatric Surgery

- Bariatric surgery should be considered for adults with BMI ≥35 kg/m^2 and type 2 diabetes, especially if the diabetes is difficult to control with lifestyle and pharmacologic therapy. (B)
- Patients with type 2 diabetes who have undergone bariatric surgery need lifelong lifestyle support and medical monitoring. (E)
- Although small trials have shown glycemic benefit of bariatric surgery in patients with type 2 diabetes and BMI of 30–35 kg/m^2, there is currently insufficient evidence to generally recommend surgery in patients with BMI <35 kg/m^2 outside of a research protocol. (E)

- Bariatric surgery should be considered for adults with BMI $\geq$ 35 kg/m^2 and type 2 diabetes, especially if the diabetes is difficult to control with lifestyle and pharmacologic therapy.

- Patients with type 2 diabetes who have undergone bariatric surgery need life-long lifestyle support and medical monitoring.

ADA Executive Summary, 2009

Quality Control

Surgery at a COE

Table 2

SRC data from 272 ASMBS Centers of Excellence with 495 surgeons reporting outcomes in more than 110,000

	n	%
Hospital mortality	76	0.14
Operative mortality at 30 d (76 + 89 = 165)	165	0.29
Operative mortality at 90 d (76 + 89 + 31 = 196)	196	0.35
Readmissions	1956	4.75
Reoperations	887	2.15

Data are based on applications.

From:
J Clin Endocrinol Metab. 2008 November; 93(11 Suppl 1): S89–S96.
doi: 10.1210/jc.2008-1641.

Safety of Bariatric Surgery

- 2007 *Agency for Healthcare Research and Quality (AHRQ)*
  - Risk of death from Bariatric Surgery approximately 0.1%
- 2009 *New England Journal of Medicine*
  - Risk of major complications (30 days) – 4.1%

Cost Effectiveness

- Health care costs for the morbidly obese are 81% above those for the non-obese population and 47% above costs for the non-morbidly obese population.

- Current costs attributable to obesity are nearly entirely a result of costs generated from treating the diseases that obesity promotes.

A Study on the Economic Impact of Bariatric Surgery

Pierre-Yves Crémieux, PhD; Henry Buchwald, MD, PhD; Scott A. Shikora, MD; Arindam Ghosh, PhD; Haixia Elaine Yang, PhD; and Marric Buessing, BA

Objective: To evaluate the private third-party payer return on investment for bariatric surgery in the United States.

Study Design: Morbidly obese patients aged 18 years or older were identified in an employer claims database of more than 5 million beneficiaries (1999-2005) using *International Classification of Diseases, Ninth Revision, Clinical Modification* code 278.01. Each of 3651 patients who underwent bariatric surgery during this period was matched to a control subject who was morbidly obese and never underwent bariatric surgery. Bariatric surgery patients and controls were matched based on patient demographics, selected comorbidities, and costs.

Methods: Total healthcare costs for bariatric surgery patients and their controls were recorded for 6 months before surgery through the end of their continuous enrollment. To account for potential differences in patient characteristics, we calculated the cost differential by estimating a Tobit model. A return on investment was estimated from the resulting coefficients. Costs were inflation adjusted to 2005 US dollars using the Consumer Price Index for Medical Care, and the cost savings were discounted by 3.07%, the 3-month Treasury bill rate during the same period.

Results: The mean bariatric surgery investment ranged from approximately $17,000 to $26,000. After controlling for observable patient characteristics, we estimated all costs to have been recouped within 2 years for laparoscopic surgery patients and within 4 years for open surgery patients.

Conclusions: Downstream savings associated with bariatric surgery are estimated to offset the initial costs in 2 to 4 years. Randomized or quasiexperimental studies would be useful to confirm this conclusion, as unobserved characteristics may influence the decision to undergo surgery and cannot be controlled for in this analysis.

(Am J Manag Care. 2008;14(9):589-596)

For author information and disclosures, see end of text.

The prevalence of obesity among the US adult population has increased steadily to reach one third of the US adult population.[1] More alarming yet, the trend in morbid obesity outpaces that of nonmorbid obesity. From 2000 through 2005, the US obesity rate increased by 24%, while the rate of morbid obesity (body mass index [BMI], calculated as weight in kilograms divided by height in meters squared ≥40) grew by 50%, and the rate of patients with a BMI exceeding 50 grew by 75%.[2,3] This trend in morbid obesity results in increased healthcare utilization and costs, as healthcare costs for the morbidly obese are 81% above those for the nonobese population and 47% above costs for the non–morbidly obese population.[4,5]

Morbid obesity is associated with a myriad of serious comorbid conditions, including hypertension, type 2 diabetes mellitus, dyslipidemia, osteoarthritis, and gallbladder disease.[6,7] Bariatric surgery has been demonstrated to be an effective weight-loss alternative for the morbidly obese[8-10] and is associated with marked resolution of comorbidities.[9] Other studies[11-13] have found similar results, with reductions in morbidity, cardiovascular risk, healthcare utilization, and costs in bariatric surgery patients compared with control subjects. Although most of the current literature examines health benefits associated with bariatric surgery,[14] studies have also documented quality-of-life improvements,[15,16] length-of-life increases,[17-19] and reduced work loss[20] associated with bariatric surgery.

Despite the extensive literature on the clinical effects of bariatric surgery, little research has been published on the economic impact of the procedure. This represents a growing gap in the literature as the clinical outcomes become better known and the procedure becomes more commonplace (>170,000 surgical procedures in 2005), while its economic costs or benefits remain unclear.[21-23] The present analysis is unique in its use of actual patient-level cost data for 3651 patients who underwent the procedure. The resulting return on investment is calculated based on up to 5 years of postoperative cost data.

This study quantifies the effect of bariatric surgery on direct medical costs. We focus on the time required for third-party payers to recover the initial investment associated with bariatric surgery (ie, the return on investment).[8] Using the Ingenix private insurer claims database and a matched cohort method and focusing only on costs incurred and saved by the private insurer, we build on findings of a

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Economic Impact of Bariatric Surgery

Take-away Points

The rate of bariatric surgery use has increased in the past decade to more than 170,000 surgical procedures per year in the United States.

- The initial investment for bariatric surgery is approximately $26,000 for open surgery and $17,000 for laparoscopic surgery.
- After taking into account age, sex, and comorbidities, the initial investment is returned within 4 years for patients who undergo open surgery and within 2 years for patients who undergo laparoscopic surgery.
- Even ignoring potential quality-of-life and length-of-life benefits, as well as disability and work loss, third-party payers can rely on bariatric surgery paying for itself through decreased comorbidities within 2 to 4 years.

Cremieux, et al. American Journal of Managed Care, Vol 14, No. 9

UW Health Bariatric Team

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Importance of Follow-up

- Long-term follow-up is an important and required component of our program
- Patients who keep all follow-up appointments and attend support group do better
- A commitment to lifelong healthy nutrition, activity, supplements and monitoring of blood work
- All patients sign a contract in which are guidelines established by the UW Health Bariatric Surgery Program to promote the success of the patient's bariatric surgery

"In the long run, the hope for diabetes lies in the dissection of the metabolic pathways uncovered by bariatric surgery and applying the findings to the development of effective medical therapies.

We can't operate on 24 million Americans."

Walter Pories, MD

Final Thoughts

Thank You

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