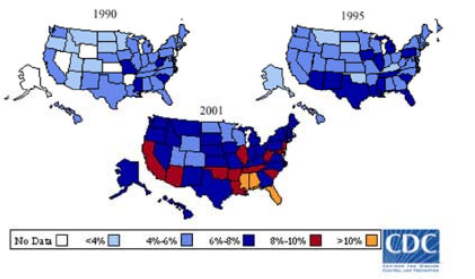
Surgical Management of Obesity-Related Metabolic Disorders

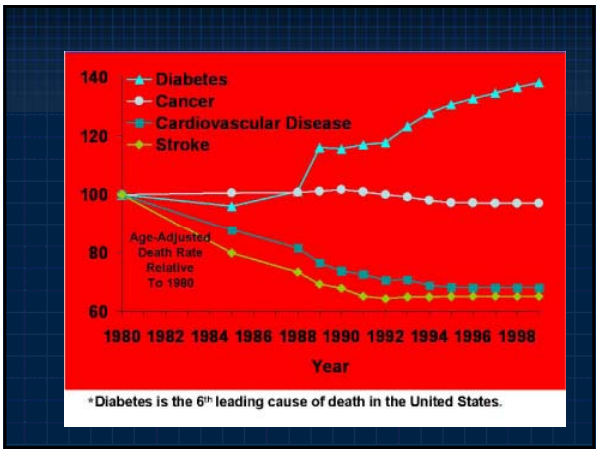
Mathew Rawlins, MD FACS
Rockwood Bariatric Specialists
Sacred Heart Medical Center

Disclosure

Dr. Rawlins declares that during the past 12 months neither he, nor any member of his family has had a financial interest in a corporate organization providing support to this continuing medical education activity.

Diabetes and Gestational Diabetes Trends Among Adults in the United States, Behavioral Risk Factor Surveillance System, 1990, 1995 and 2001





Co-Morbidities of Obesity

- Coronary Disease
- Hypertension
- Dyslipidemias
- Pulmonary insufficiency
- Sleep apnea
- Gastroesophageal reflux
- Diabetes mellitus
- Steatohepatitis/cirrhosis
- Peripheral vascular
- Chronic venous stasis
- Metabolic Syndrome
- Osteoarthritis
- Dysmenorrhea
- Malignancies
- Pseudotumor cerebri
- Urinary incontinence

Metabolic Surgery

American Society for Metabolic and Bariatric Surgery

The goal of treatment

An improvement in health via a durable weight loss that:

↓ co-morbidities

↑physical ability

Outline

- **Indications for bariatric surgery**
- **Types of bariatric surgery**
- **Outcomes**
  - **Weight-loss**
  - **Mortality**
  - **Effect on Co-morbidities**
  - **Complications**

Who is an appropriate candidate for surgery?

NIH Criteria :

1. BMI > 40 kg/m2 (or >100 lbs above normal weight)

2. BMI 35-40 kg/m2 *if* significant co-morbidities exist

3. Failed attempts at non-surgical therapy

4. Well-informed, highly motivated patient (ownership and assertiveness Kanter)

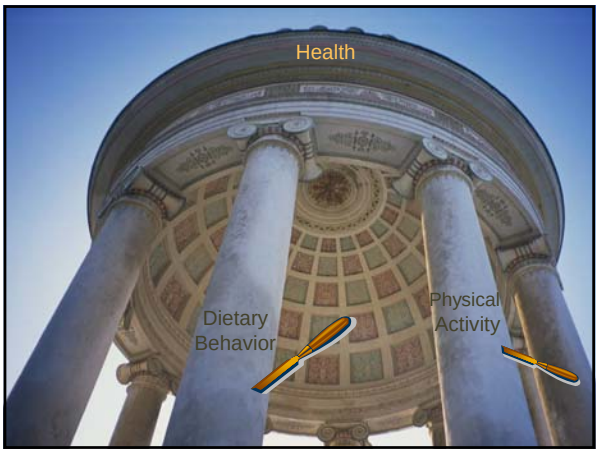
*1991 NIH Concensus Conference on Gastrointestinal Surgery for Severe Obesity

Quantifying Obesity

- Basic Weight
- Body Mass Index (kg/m2
- Waist-to-Hip Ratios
- % body fat
- Intra-abdominal Adiposi

Tools for Weight Loss

- Diet modification
- Exercise
- Medications
- Behavioral & nutritional counseling
- Surgery



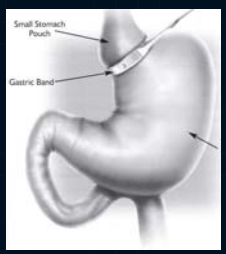
Range of Surgical Options

Restrictive	Combination	Malabsorptive
Adjustable Gastric Banding Vertical-banded gastroplasty	Roux-Y Gastric Bypass	Biliopancreatic diversion Duodenal switch

Restrictive Procedures

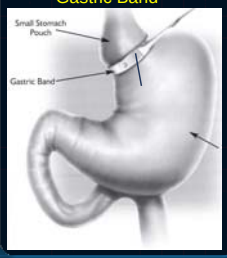
Vertical-Banded Gastroplasty

Gastric Banding

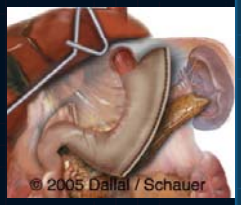


Restrictive Procedures

Laparoscopic Adjustable Gastric Band

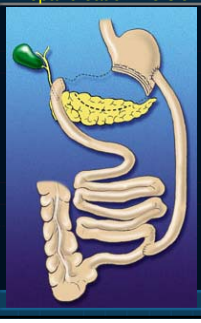


Sleeve Gastrectomy

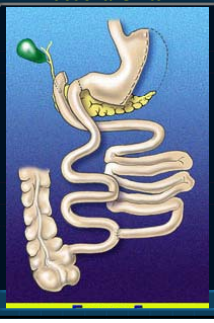


Malabsorptive Procedures

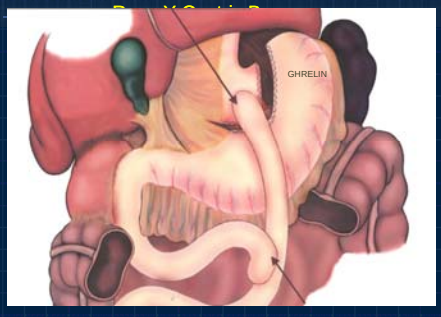
Biliopancreatic Diversion



Duodenal Switch



Combination Procedure



Percent excess weight lost

Buchwald et al. Bariatric Surgery: A Systematic Review and Meta-analysis, JAMA, Oct. 2004

	% excess weight lost All patients	% excess weight lost Diabetics
Gastric Banding n=1848	49%	41%
Gastric Bypass n=4204	68%	67%
Biliopancreatic Diversion or Duodenal Switch n=2480	72%	N/A

Variable timing of endpoints: meta-analysis

Percent excess weight lost

Prospective Randomized Study Between Laparoscopic Gastric Bandingand Laparoscopic Isolated Sleeve Gastrectomy:
Results after 1 and 3 years

Himpens et al. Obesity Surgery 2006: 16: 1450-1456

	% excess weight lost at 1 year	% excess weight lost at 3 years
Sleeve Gastrectomy	57%	66%
Laparoscopic Band	41%	48%

Percent excess weight lost

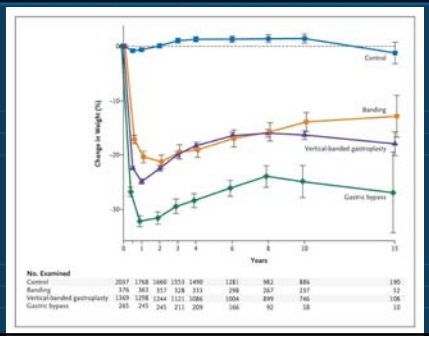
A Prospective Multicenter Study of 163 Sleeve Gastrectomies:
Results at 1 and 2 years

Nocca et al, Obesity Surgery 2008 (18) 560-565

	% excess weight lost at 1 year	% excess weight lost at 2 years
Sleeve Gastrectomy	59% N=120	61% N=98

Change in Weight %

Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects
Sjostrom, Lars et al. N Engl J Med, 2007



Early Mortality Among Medicare Beneficiaries Undergoing Bariatric Surgical Procedures

Flum, et al. JAMA, October 2005

- 16, 155 Medicare patients between 1997-2002
- Overall 30 day mortality 2.0%
- Five fold higher mortality for pt >75 yr old

Effect of patient age and surgeon volume on early mortality in Medicare patients

	30 Day Mortality	
Surgeon Volume (by quartile)	Pt age <65 yrs	Pt age >65 yrs
<15 cases/ yr	2.2%	9.0%
15-35 cases/yr	1.7%	3.2%
36-70 cases/yr	1.7%	1.8%
71-268 cases/ yr	1.2%	1.1%

Early MortalityAmong Medicare Beneficiaries Undergoing Bariatric Surgical Procedures
Flum, et al. JAMA, October 2005

30 day Mortality
after Bariatric Procedures

Buchwald et al. Bariatric Surgery: A Systematic Review and Meta-analysis, JAMA 2004

- Gastric Band 0.1%
- Gastric Bypass 0.5%
- Biliopancreatic Diversion 1.1%

Long-Term Mortality after Gastric Bypass Surgery

Adams, Ted D et al. N Engl J Med, 2007

- Retrospective Cohort Study: 1984-2002
  - 7925 pts underwent Gastric Bypass
  - 7925 obese driver's license applicants
  - Matched for age, sex, BMI
- Mean F/U 7.1 yrs

Long-Term Mortality after Gastric Bypass Surgery

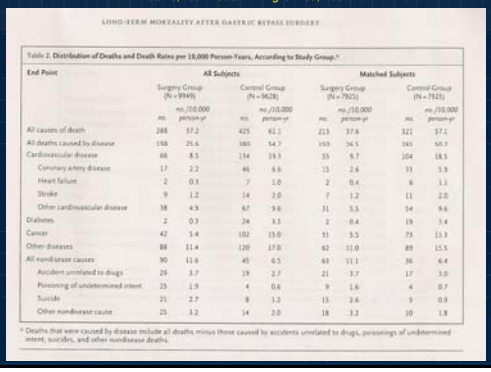
Adams, Ted D et al. N Engl J Med, 2007

Matched Subjects

	Surgery Group N=7925	Control Group N=7925	
Death Rates	no./10,000 person-yr	no./10,000 person-yr	%Reduction in mortality
All causes of death	37.6	57.1	↓40% p<0.001
Cardiovascular	9.7	18.5	↓49% p<0.001
Diabetes	0.4	3.4	↓92% p=0.005
Cancer	5.5	13.3	↓60% p<0.001
Non-disease causes	11.1	6.4	↑58% p=0.04

Long-Term Mortality after Gastric Bypass Surgery

Adams, Ted D et al. N Engl J Med, 2007



LONG-TERM MORTALITY AFTER GASTRIC BYPASS SURGERY

Table 2. Distribution of Deaths and Death Rates per 10,000 Person-Years, According to Study Group.*

End Point	All Subjects				Matched Subjects			
	Surgery Group (N = 9949)		Control Group (N = 9628)		Surgery Group (N = 7925)		Control Group (N = 7925)	
	no.	no./10,000 person-yr	no.	no./10,000 person-yr	no.	no./10,000 person-yr	no.	no./10,000 person-yr
All causes of death	288	57.2	425	81.1	213	37.6	321	57.1
All deaths caused by disease	198	25.6	380	54.7	150	24.5	285	50.7
Cardiovascular disease	66	8.5	134	19.3	55	9.7	104	18.5
Coronary artery disease	17	2.2	46	6.6	15	2.6	33	5.9
Heart failure	2	0.3	7	1.0	2	0.4	6	1.1
Stroke	9	1.2	14	2.0	7	1.2	11	2.0
Other cardiovascular disease	38	4.9	67	9.6	31	5.5	54	9.6
Diabetes	2	0.3	24	3.5	2	0.4	19	3.4
Cancer	42	5.4	102	13.0	31	5.5	75	13.3
Other diseases	88	11.4	120	17.0	62	11.0	89	15.5
All nondisease causes	90	11.6	45	6.5	63	11.1	36	6.4
Accident unrelated to drugs	29	3.7	19	2.7	21	3.7	17	3.0
Poisoning of undetermined intent	15	1.9	4	0.6	9	1.6	4	0.7
Suicide	21	2.7	8	1.2	15	2.6	5	0.9
Other nondisease cause	25	3.2	14	2.0	18	3.2	10	1.8

* Deaths that were caused by disease include all deaths minus those caused by accidents unrelated to drugs, poisonings of undetermined intent, suicides, and other nondisease deaths.

Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects

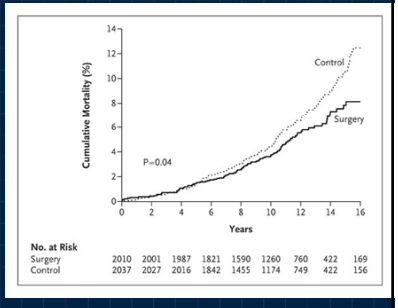
Sjostrom, Lars et al. N Engl J Med, 2007

- **Prospective controlled study**
  - **2010 patients in surgical group**
  - **2037 patients in matched control group**
  - **10.9 years mean F/U**

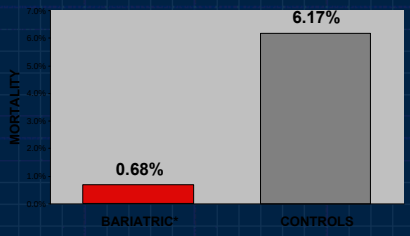
Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects

Sjostrom, Lars et al. N Engl J Med, 2007

- **Deaths**
  - **101 in surgery group**
  - **129 in control group**
  - **Hazard ratio 0.71 (p=0.01)**
  - **(adjusted for sex, age, risk factors)**



5-Year Mortality



Christou NV, Sampalis JS, Liberman M, et al. Surgery Decreases Long-Term Mortality, Morbidity, and Health Care Use in Morbidly Obese Patients. Annals of Surgery 2004;240(3):416-424.

Effect on Diabetes

Buchwald et al. Bariatric Surgery: A Systematic Review and Meta-analysis, JAMA, Oct. 2004

	resolved	Improved or resolved	HbA1c (mean change)
Gastric Band	48% n=205	81% n=217	-1.2%
Gastric Bypass	84% n=989	93% n=127	-3.0%

Effect on Diabetes

Adjustable Gastric Band vs Conventional Therapy for Type 2 Diabetes: A Randomized Controlled Trial

Dixon et al. JAMA, 2008

- **60 patients randomized**
  - Age: 20-60 yr
  - BMI: 30-40
  - Type 2 DM diagnosed within 2yrs
- **24 month follow-up**

Effect on Diabetes

Adjustable Gastric Band vs Conventional Therapy
for Type 2 Diabetes
A Randomized Controlled Trial

Dixon et al. JAMA, 2008

- **1° end point -- glycemic control at 2yrs**
- **2° outcome measures --**
  - Wt
  - BP
  - Lipids (TG, chol)

Effect on Diabetes

Adjustable Gastric Band vs Conventional Therapy
for Type 2 Diabetes
A Randomized Controlled Trial
Dixon et al. JAMA, 2008

- **Band Treatment Group**
- **Lap-Band after randomization**
- **F/U every 4-6 wks x 2yrs**
- **Adjustments per protocol**

Effect on Diabetes

Adjustable Gastric Band vs Conventional Therapy
for Type 2 Diabetes
A Randomized Controlled Trial
Dixon et al. JAMA, 2008

- **Medical Treatment Group**
- **Best available medical tx**
  - Early intensive use of insulin unusual
  - TZDs restricted
  - Exenatide not available
- **Open access to**
  - General physician
  - Nurse
  - Dietician
  - Diabetes Educator
- **Visit with 1 or more team member every 6 wks x 2yrs**

Effect on Diabetes
Adjustable Gastric Band vs Conventional Therapy
for Type 2 Diabetes
A Randomized Controlled Trial
Dixon et al. JAMA, 2008

Follow-up

Band	Medical Tx
N=30	N=30
1 withdrew pre-op 29 operated 29 f/u at 2yr	26 completed 2yr f/u

Effect on Diabetes
Adjustable Gastric Band vs Conventional Therapy
for Type 2 Diabetes
A Randomized Controlled Trial
Dixon et al. JAMA, 2008

Results: Weight-loss

	Band	Medical Tx
Mean % Excess weight loss	62.5%	4.3%

P<.001

Effect on Diabetes
Adjustable Gastric Band vs Conventional Therapy
for Type 2 Diabetes
A Randomized Controlled Trial
Dixon et al. JAMA, 2008

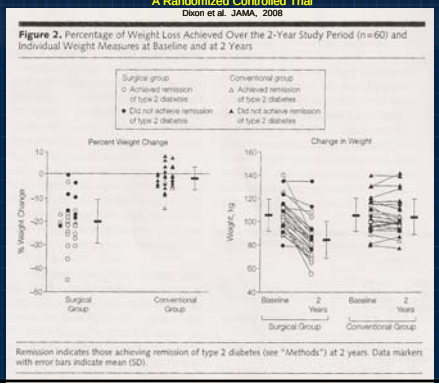


Figure 2. Percentage of Weight Loss Achieved Over the 2-Year Study Period (n=60) and Individual Weight Measures at Baseline and at 2 Years

Remission indicates those achieving remission of type 2 diabetes (see "Methods") at 2 years. Data markers with error bars indicate mean (SD).

Effect on Diabetes

Adjustable Gastric Band vs Conventional Therapy for Type 2 Diabetes: A Randomized Controlled Trial

Dixon et al. JAMA, 2008

Results: Diabetes

	Band	Medical Tx	
Remission	22/30 (73%)	4/30 (13%)	P<.001
Hb A1c <6.2			
Baseline--	2 (7%)	4 (13%)	
2 yr--	24 (80%)	6 (20%)	
Off Diabetes Meds			
Baseline--	2 (7%)	4 (13%)	
2yr--	26 (87%)	8 (27%)	

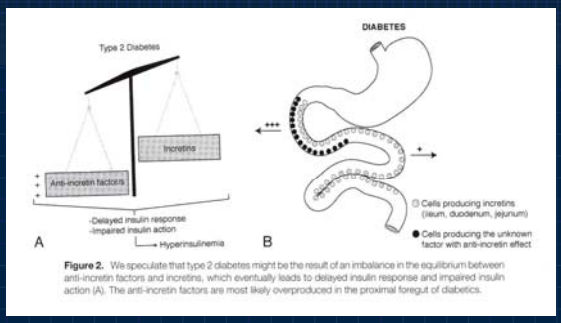


Figure 2. We speculate that type 2 diabetes might be the result of an imbalance in the equilibrium between anti-incretin factors and incretins, which eventually leads to delayed insulin response and impaired insulin action (A). The anti-incretin factors are most likely overproduced in the proximal foregut of diabetics.

*Rubino, Annals of Surgery, 2002

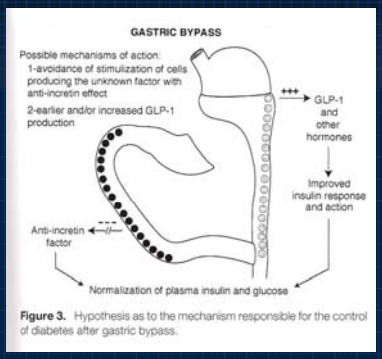
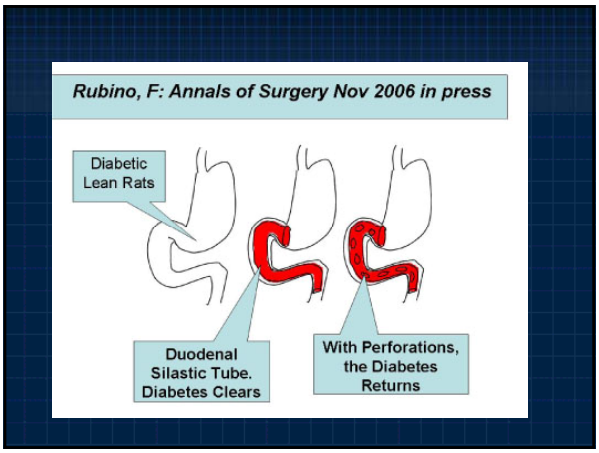


Figure 3. Hypothesis as to the mechanism responsible for the control of diabetes after gastric bypass.



Effect on Co-morbidities

Buchwald et al. Bariatric Surgery: A Systematic Review and Meta-analysis, JAMA, Oct. 2004

	Gastric Band		Gastric Bypass	
Outcome	T(n/N)	% Improved / resolved [95%CI]	T(n/N)	% Improved / resolved [95%CI]
Sleep Apnea	3 (18)	68.0% [26.2-100.0]	6 (176)	94.8% [91.5-98.1]
Hypertension	10 (685)	70.8% [61.9-79.6]	11 (435)	87.2% [78.4-95.9]
Hyperlididemia	6 (426)	58.9% [28.2-89.6]	6 (125)	96.9% [93.6-100]

Effect of Gastric Bypass on Co-Morbidities

	% Improved	% Resolved	Total % improved or resolved
OA/DJD	47	41	88
HIGH CHOLESTEROL	33	63	96
GERD	24	72	96
HTN	18	70	88
COSA	19	74	93
ASTHMA	69	13	82
DM	18	82	100

*Schauer, Annals of Surgery, 2000

Band vs Bypass

Bowne et al. Archives of Surgery, July 2006

- Prospective Comparative Analysis
- Self-selected homogenous groups (age, BMI, comorbidities)
- 106 pts, mean F/U 16 months

Band vs Bypass

Bowne et al. Archives of Surgery, July 2006

	Band N=60	Bypass N-46
Early complications	18%	17%
Late complications	78%	28%
Re-operations	25%	6%
% Excess Wt Lost (16 mo)	31%	52%
Very Satisfied	46%	80%
Satisfied	35%	20%

Complications
of any Bariatric Procedure

DVT with Pulmonary Embolus

Dehydration

Respiratory Failure

Cardiac event

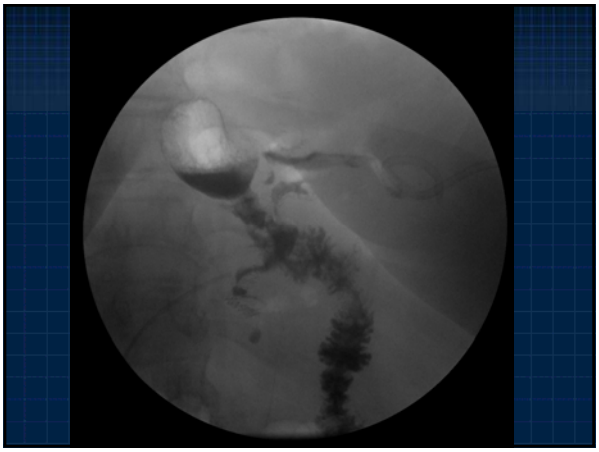
Bleeding

Wound issues

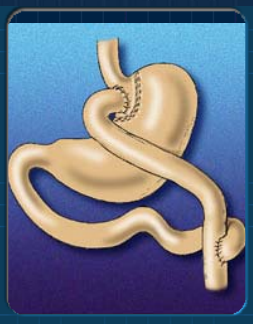
Death

Complications of Gastric Bypass
Anastomotic Leak

- Surprisingly subtle (initially)
- Tachycardia
- Fever/abdominal pain
- High index of suspicion
- Immediate re-op
- Incidence:
  - Up to 3% nationwide
  - 0.4% in our practice



Complications of Gastric Bypass
Anastomotic Stricture

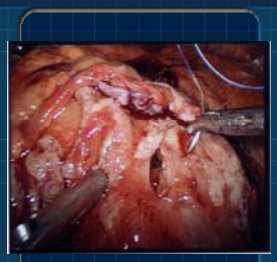


- "Early" or "late" onset
- New-onset vomiting
- Progressive dysphagia
- Dx: EGD
- Rx: Balloon dilation
- 5-10% incidence

Complications of Gastric Bypass
Marginal Ulcer

- Epigastric pain (burning)
- Bleeding/perforation
- NSAIDS often implicated
- Dx: EGD
- Rx:
  - PPI, sucralfate
  - Discontinue NSAIDS
- 5-10% incidence

Complications of Gastric Bypass
Marginal Ulcer



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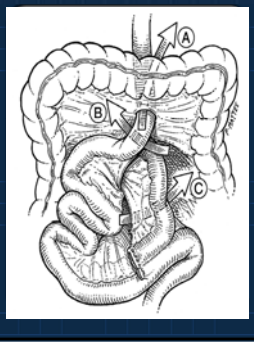
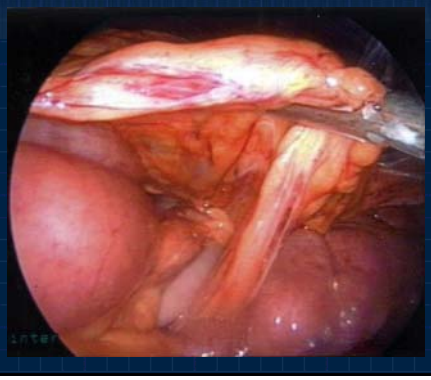
Complications of Gastric Bypass
Internal Hernia

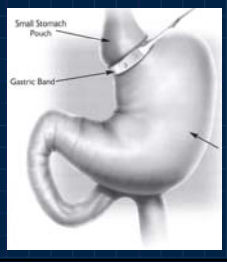


- Unrelenting abdominal pain
- Epigastric
- Nausea/dry heaves (maybe)
- Radiography generally unhelpful
- Dx: laparoscopy
- Rx: surgical reduction/repair
- Incidence
  - was 5%, now <1%

Internal Hernia



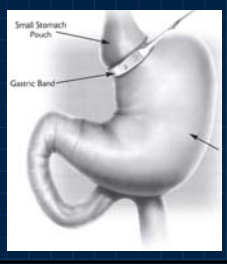
Complications of the Band
Tubing and Port



- Revision in up to 11% of patients*
  - infection
  - leak
  - kink

*Favretti et al. Obes. Surg. 2002

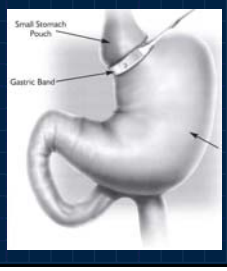
Complications of Band: Erosion



- Incidence up to 3%*
  - ↓ with Pars Flacida technique
- Results in:
  - Pain
  - Hemorrhage
  - Perforation

*O'Brien and Dixon. Am. J. Surg 2002

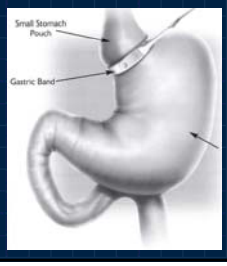
Complications of Band: Prolapse



- Incidence: 4.5 to 25%*
- Causes
  - GERD
  - Dysphagia
  - Ischemia
  - Pain
  - Nausea/Vomiting
- Treatment
  - Band repositioning
  - Band replacement
  - Band removal

*O'Brien and Dixon. Am. J. Surg 2002

Complications of Band: Esophogeal Dilation



- Incidence estimated from <5% to 10%*
- ? Long-term effects on motility

*US FDA trial A

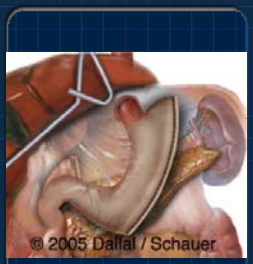
Complications of the Band

- **Reoperations**
- Furbetta et al. "The Italian Experience"* (6,091 pts)
- Pre 2001: Reoperation required in 29%
- Post 2001: Reoperation required in 11%

- Silecchia et al.* (500 patients)
- 12% overall (major operation)
- 24% when followed >5 yrs

*Presented at ASBS, June 2007

Complications of Sleeve Gastrectomy



- Staple line leak
- Gastric stricture
- GERD
  - worse after 1 year
  - better after 3 years

Other Potential Difficulties after Bariatric Surgery

- Protein deficiency
- Micronutrient deficiencies (eg. calcium, B12, iron, folate)
- Risk of gallstones
- Weight regain

Protein Deficiency

- ★ **Typically incidental finding**
- ★ **60 gms/day needed**
- ★ **Greater percentage of caloric intake**
- ★ **Alternative protein sources**
- ★ **Protein supplements always an option**

Micronutrients

- Calcium
- B12 (needs IF)
- Iron absorption relies on HCL & duodenum
- Folate
- Thiamine

Weight Regain

Anatomic

After Bypass
Gastro-gastric fistula
Enlarged stoma
Enlarged pouch

After Sleeve
Remnant dilation

After Band
Inadequate Fill

Behavioral

"Grazing"
Soft or liquid calories
Maladaptive eating

Management of Medication

- Crushed pills or elixir
- Divide doses for long-acting / timed release
- Lack of HCL to process medications
  (calcium citrate rather than calcium carbonate)
- Avoid NSAIDS

Mgmt of Resolving Co-Morbidities

- GERD
- Hypertension
- Diabetes
  - Beware of hypoglycemia
  - TZD's likely helpful for metabolic syndrome
- Sleep apnea
  - May need repeat testing

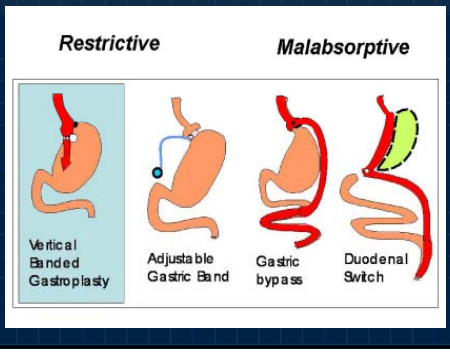
Long term management after bariatric surgery

- Scheduled surgical follow-up and dietary counseling (2 wk, 3mo, 6mo, yearly x5yrs)
- Routine lab screening
- Appropriate diet
- Exercise program
- Support groups
- Psychologic and nutritional support as needed

Emotional Impact of Bariatric Surgery

- Other non-hunger cues for eating
- Replacement of means of comfort
- Psycho-social effects of weight loss

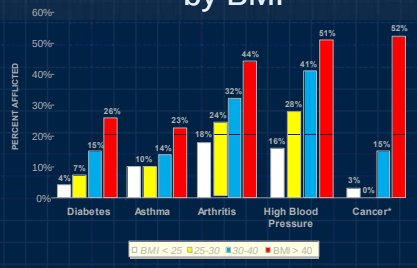
Current Procedures for Weight-loss



Practice Recommendation

- **Surgically induced loss of weight should be considered early in the treatment of obese patients with type 2 diabetes.**
- **Strength of evidence:**
- **Unblinded randomized controlled trial (strong)**
- **Source:**
- **Dixon JB, O'Brien PE, Playfair J, et al. "Adjustable Gastric Banding and Conventional Therapy for Type 2 Diabetes". JAMA 2008; 299 (3): 316-323.**

Prevalence of Comorbidities by BMI



Mokdad AH, et al. JAMA 2002;289:76.
Centers for Disease Control, National Center for Health Statistics, National Health and Nutrition Examination Survey
* Increase in mortality rate from cancers of all kinds compared to lowest risk group (BMI 25-30). From: Call EE, et al. Overweight, obesity and mortality from cancer in a prospectively studies cohort of US adults. New Engl J Med 2003;348:1625.