Sleeve Gastrectomy

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20 % of children

65 % of adults

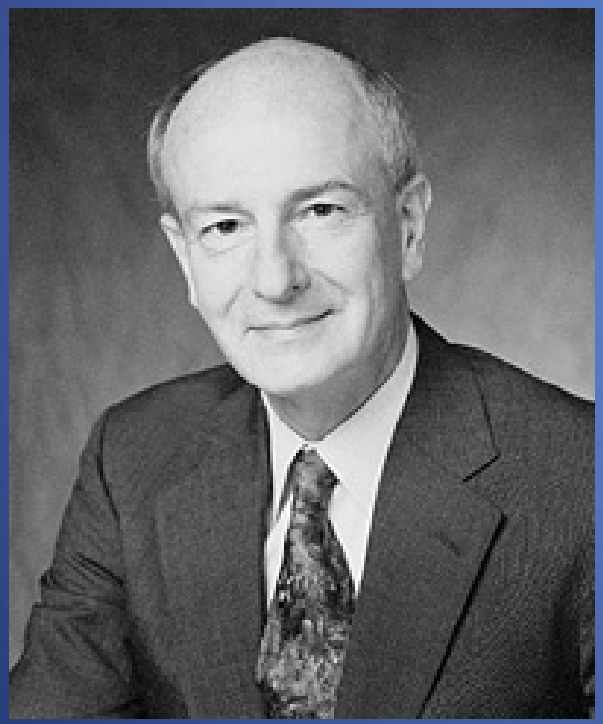
are Overweight.

- 2/3 US population is overweight - 50 million people
- 20% of US population is Morbidly Obese
  - From 1986-2000: prevalence of obesity quadrupled; super obesity increased five fold
- Over 400,000 deaths per years are attributed to obesity
  - second only to smoking

Classification	BMI	Risk of comorbidities
Underweight	< 18.5	Low (but risk of other clinical problems increased)
Normal range	18.50–24.99	Average
Overweight	≥25.00	
Preobese	*25.00–29.99*	*Increased*
Obese	≥30.00	
Obese class I	*30.00–34.99*	*Moderate*
Obese class II	*35.00–39.99*	*Severe*
Obese class III (morbid obesity)[a]	*≥40.00*	*Very severe*

BMI, body mass index.
a When BMI is over 50 this is sometimes referred to as 'super-obesity'.

“It has been said that a characteristic of adult humans is their capacity for relationships, accountability and change.”



- The standalone Duodenal Switch procedure was originally devised by Dr. Tom DeMeester to treat bile gastritis

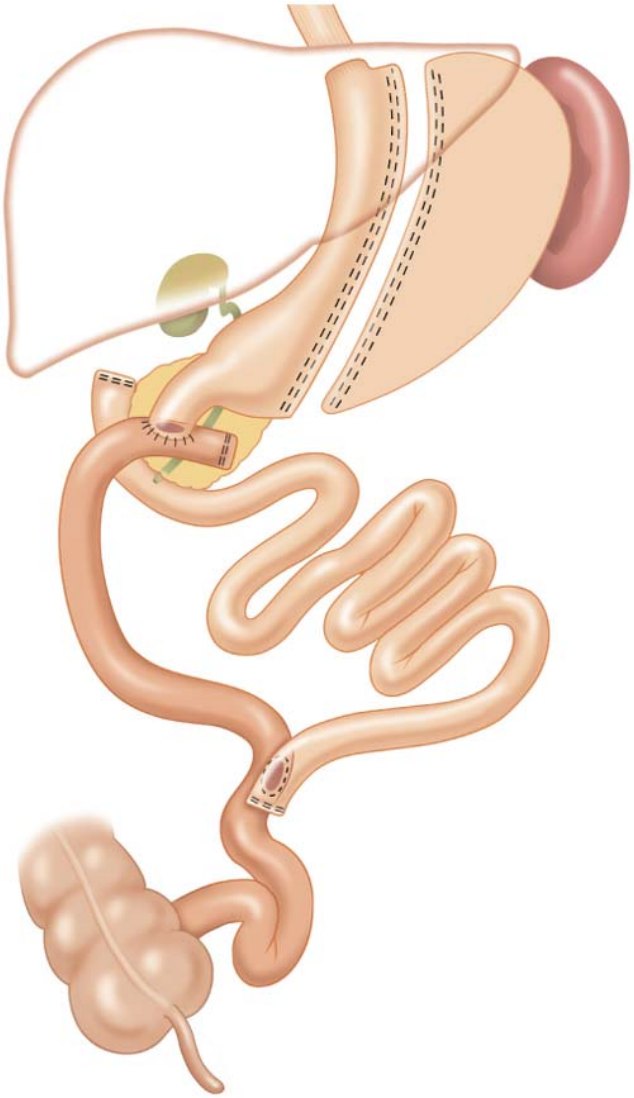


FIGURE 2. Duodenal switch

Dr. Douglas Hess

- March 1988, Doug Hess preformed the first open Sleeve Gastrectomy
- The patient had a BMI of 60 and 17 years later had a BMI of 29

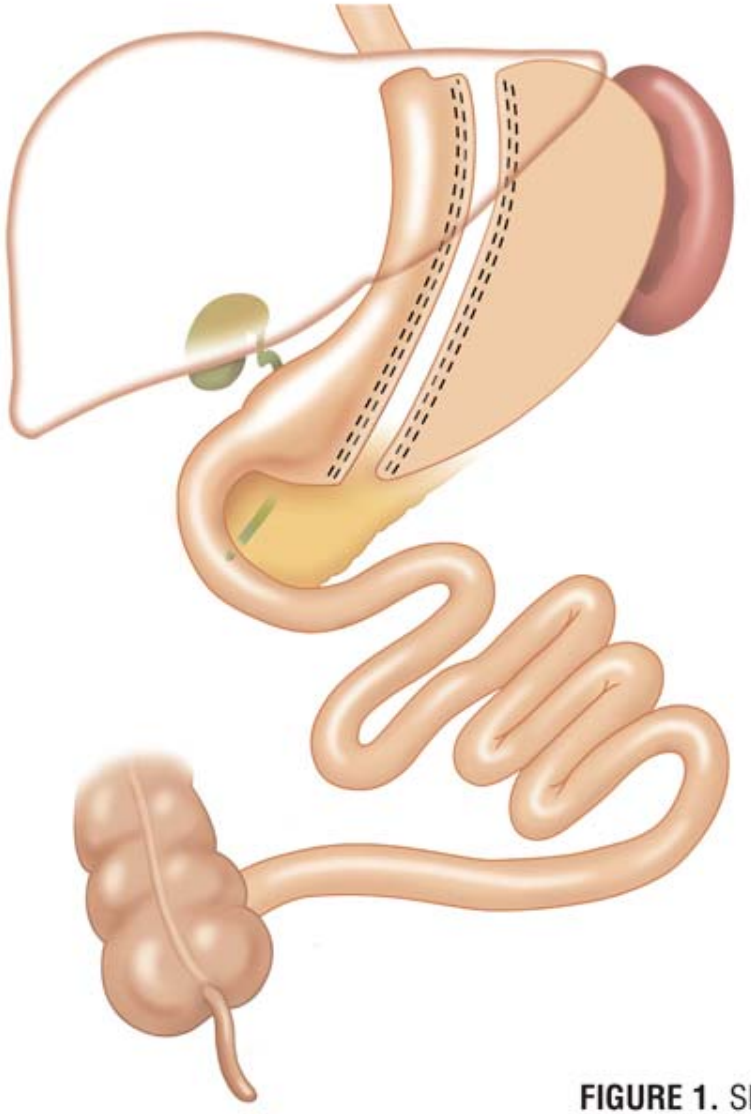
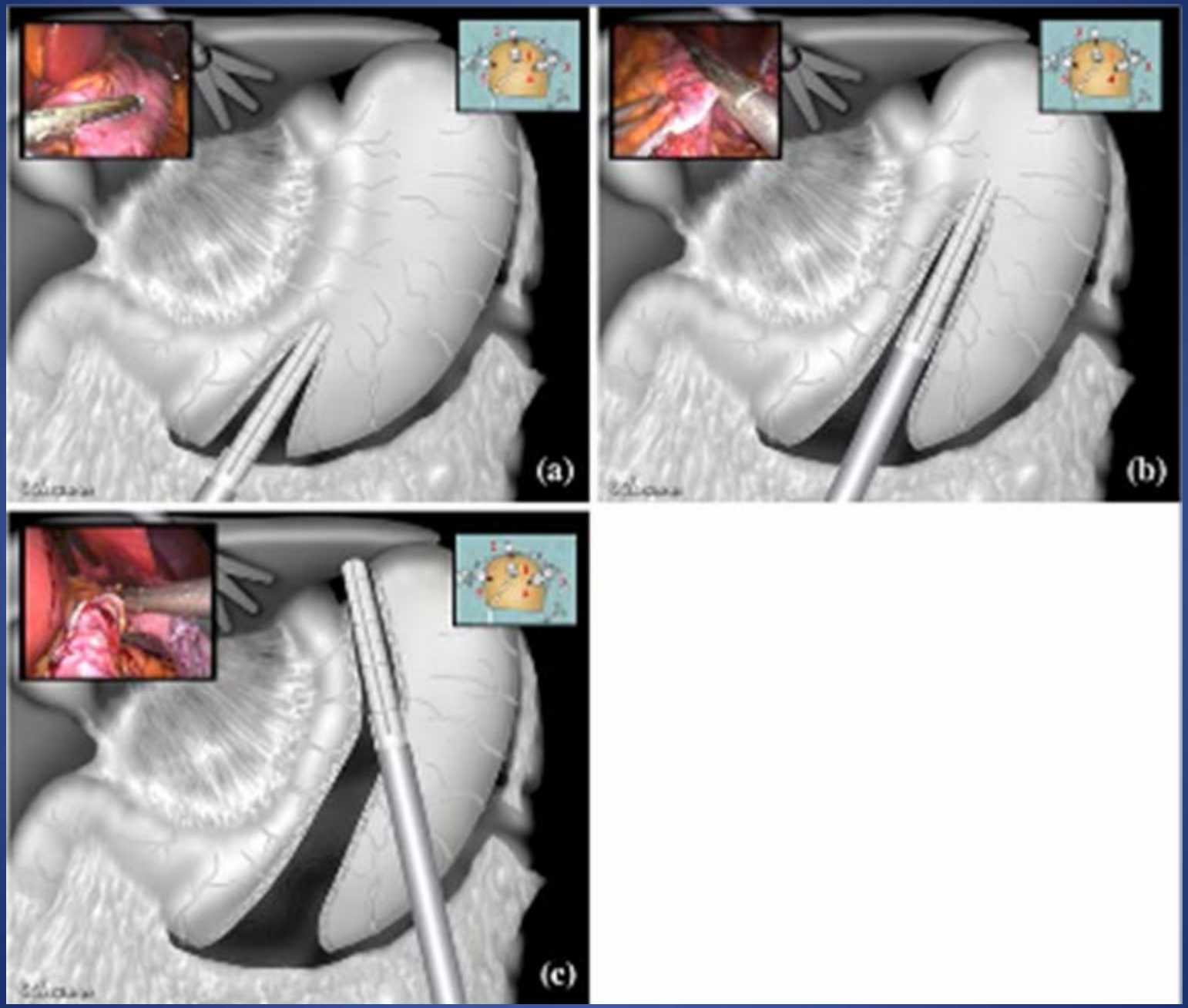


FIGURE 1. Sleeve gastrectomy


(a)
(b)
(c)

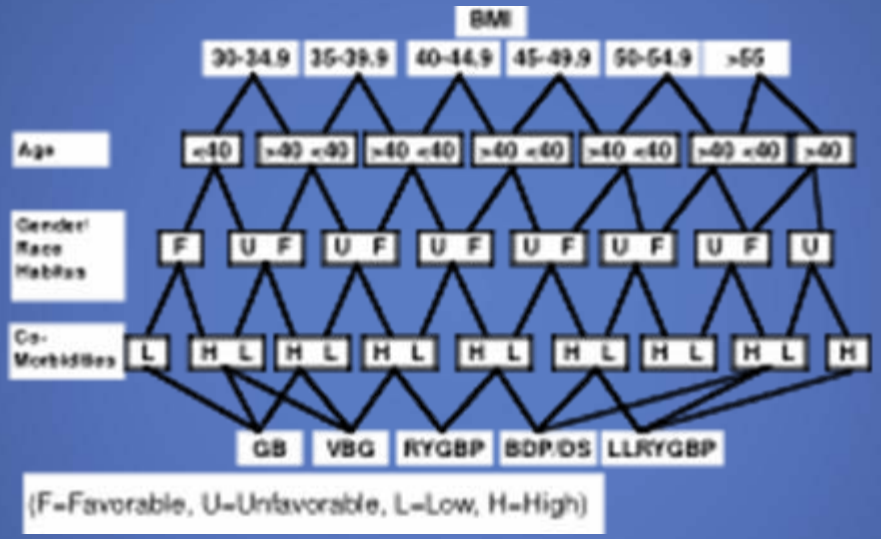
The Optimal Surgical Management of the Super-Obese Patient: The Debate

Eric J. DeMaria, MD, Moderator	*Duke University*
Philip Schauer, MD	*Cleveland Clinic*
Emma Patterson, MD	*The Oregon Clinic*
Ninh T. Nguyen, MD	*University of California, Irvine*
Brian P. Jacob, MD, and William B. Inabnet, MD	*Columbia University*
Henry Buchwald, MD, PhD	*University of Minnesota*

Presented at the Annual Meeting of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), Hollywood, FL, April 13-16, 2005.

A Bariatric Surgery Algorithm

Henry Buchwald, MD, PhD, FACS



OC = 1.0 + BMI Number (1-6) ± 0.5 (age <40>) ± 0.5 (GRH, Favorable or Unfavorable) ± 1 (CoM, Low or High).

OC (operative category): GB = 0-3; VBG = 2-5; RYGBP = 3-6; BPD/DS = 4-7; LLRYGBP = 6-9.

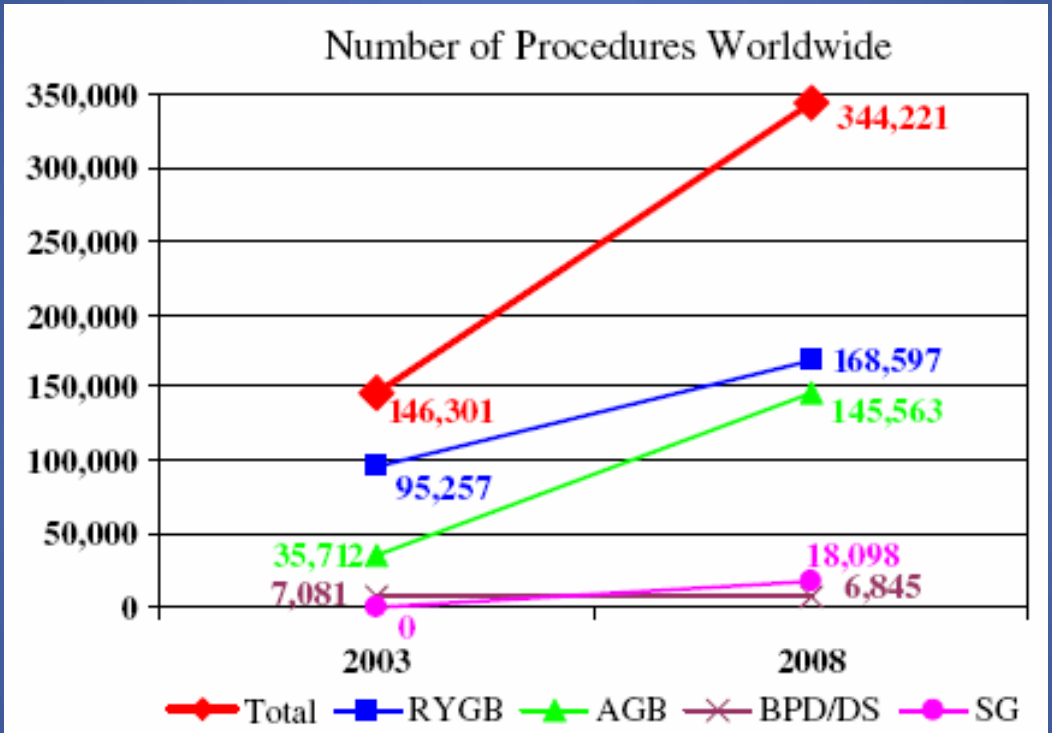


Fig. 1 Trends in number of procedures worldwide

“Sleeve Explosion”

- Technically not a difficult operation (after a learning curve)
- Effective Weight Loss
- Low Rate of Morbidity and Mortality
- No Nutrient Malabsorption
- No “Blind” Stomach
- No Dumping Syndrome
- Feasibility of Postoperative Endoscopic Cholangiography
- Standard Second Stage procedure - BPD-DS or LRYGB in case of failure
- The lack of a foreign body
- Preservation of the pylorus
- Non-altering of the absorption of orally administered drugs

- Studies report a weight loss after LSG ranging from 35% to 72% excess body weight loss (EWL) and 51–83% at 12 months

- Various studies refer complication rates that vary from 0% to 24% with an overall mortality rate of 0.39%

Table 1 Summary of clinical outcomes of LSG as compared to LRYGB and LAGB

Outcomes	LAGB[a]	LRYGB[a]	LSG
Number of cases	3,374	3,195	940
Operative time (min)	77.5	164.8	100.4
Hospital stay (days)	1.7	4.2	4.4
%EWL (1 year)	37.8%	62.8%	59.8%
%EWL (2 year)	45.0%	54.4%	64.7%
%EWL (3 year)	55.0%	66.0%	66.0%
Comorbidity resolution	41-59%	65-84%	45-95.5%
Complications	6.50%	9.50%	12.1%
Mortality	0.47%	0.56%	0.3%

Himpens, 2006[129]	LAGB ($n = 40$)	LISG ($n = 40$)	p-value
% EWL at 1 year (median, range)	41.4 (−11.8 to 130.5)	57.7 (0 to 125.5)	$p = 0.0004$
% EWL at 3 years (median, range)	48 (0 to 124.8)	66 (−3.1 to 152.4)	$p = 0.0025$
Weight loss at 1 year (kg, median, range)	14 (−5 to 38)	26 (0 to 46)	$p < 0.0001$
Weight loss at 3 years (kg, median, range)	17 (0 to 40)	29.5 (1 to 48)	$p < 0.0001$
BMI decrease at 1 year (median, range)	15.5 (5 to 39)	25 (0 to 45)	$p < 0.0001$
BMI decrease at 3 years (median, range)	18 (0 to 39)	27.5 (0 to 48)	$p = 0.0004$

BMI, body mass index; EWL, excess weight loss; LAGB, laparoscopic adjustable gastric banding; LISG, laparoscopic isolated sleeve gastrectomy.

Effectiveness of Laparoscopic Sleeve Gastrectomy (First Stage of Biliopancreatic Diversion with Duodenal Switch) on Co-Morbidities in Super-Obese High-Risk Patients

Gianfranco Silecchia, MD, PhD[1]; Cristian Boru, MD[1]; Alessandro Pecchia, MD[1]; Mario Rizzello, MD[1]; Giovanni Casella, MD[1]; Frida Leonetti, MD[2]; Nicola Basso, MD[1]

- Hypertension
- Type 2 Diabetes/ Impaired glucose tolerance
- Obstructive Sleep Apnea
- ASA score

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REVIEW

A Review of Laparoscopic Sleeve Gastrectomy for Morbid Obesity

Xinzhe Shi · Shahzeer Karmali · Arya M. Sharma · Daniel W. Birch

Table 5 The improvements of comorbidities after LSG

	Cottam (2006) [22]	Han (2005) [23]	Milone (2005) [25]	Silecchia (2006) [18]	Average R+I
Patients	126	60	20	41	247
Follow-up	1 year	1 year	6 months	18 months	6–24 months
Type 2 diabetes	81%R 11%I	100%R	30%I	79.6%R 15.4%I	77.2%
Hypertension	78%R 7%I	93%R 7%I	55%I	62.5%R 25%I	71.7%
Hyperlipidemia	73%R 5%I	45%R 30%I	30%I	–	61%
Sleep apnea	80%R 7%I	100%R	60%I	56.2%R 31.2%I	83.6%
Degenerative Joint disease	85%R 6%I	76%R 24%I	95%I	–	95.3%
Gastro- esophageal Reflux	70%R 8%I	80%R 20%I	25%I	–	67.7%
Peripheral Edema	91%R 3%I	–	–	–	94%
Depression	67%R 9%I	–	14%I	–	45%

R resolved; *I* improved

- LSG has emerged as a restrictive operation, but its ability to extend beyond that through hormonal modifications raises a promise that it will play a leading role in the future of bariatric surgery, either as a sole operation or as part of a more extended procedure

Weight Loss, Appetite Suppression, and Changes in Fasting and Postprandial Ghrelin and Peptide-YY Levels After Roux-en-Y Gastric Bypass and Sleeve Gastrectomy

A Prospective, Double Blind Study

Stavros N. Karamanakos, MD, Konstantinos Vagenas, MD, Fotis Kalfarentzos, MD, FACS, and Theodore K. Alexandrides, MD

- Prospective, Double-Blinded Study
  - 16 pt LRYGB, 16 LSG
  - Pt's evaluated 1st, 3rd, 6th, 12th postoperative month
- Blinding as to the type of the procedure involved the patient and the medical staff, and the independent data collector

- Both procedures resulted in similar increases in fasting and postprandial PYY levels but only LSG suppressed fasting and postprandial ghrelin levels significantly

Karamanakos, 2008[125]	LRYGBP ($n = 16$)	LSG ($n = 16$)	p-value
BMI at 12 months	31.5 (± 3.4)	28.9 (± 3.6)	$p = 0.41$
% EWL at 12 months	60.5 (± 10.7)	69.7 (± 14.6)	$p = 0.05$
Weight loss at 12 months (kg)	40.0 (± 8.3)	43.6 (± 11.7)	$p = 0.322$

BMI, body mass index; EWL, excess weight loss; LRYGBP, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic sleeve gastrectomy.
All mean (± SD).

Table 1 Weight control hormones that have been studied after LSG

Hormone	Origin	Site of action	Mechanism of action in obesity	Effect on weight	Levels post-LSG	References
Ghrelin	Primarily stomach fundus	Acts on arcuate and solitary hypothalamic nuclei	Stimulates GH release	Stimulates appetite	Reduced	[31–33]
				Reduces metabolic rate		[50, 51]
	Pancreas		Opposes leptin actions			[54, 55]
	Intestine			Reduces fat catabolism		[57]
PYY	Enteroendocrine L cells of ileum and colon	Gastrointestinal epithelium, arcuate nucleus	Associated with IR and insulin secretion	Induces satiety	Increased	[57–60] [63]
Leptin	Adipocytes	Acts on arcuate nucleus	Inhibits NPY and activates POMC neurons	Anorectic	Reduced	[66–68]

Ghrelin

- Ghrelin is produced by cells scattered throughout the gastrointestinal tract but mainly by the oxyntic cells in the fundus of the stomach
  - Represents an endogenous hormone that stimulates release of growth hormone (GH) from the hypothalamus
  - Levels rise preprandially and fall proportionately in response to calorie ingestion
  - Ghrelin seems to suppress the insulin-sensitizing hormone adiponectin, block the hepatic insulin signaling, and inhibit insulin secretion

- Ghrelin levels increased after diet induced weight loss, whereas weight loss after gastric bypass was associated with markedly suppressed ghrelin levels

Peptide-YY

- Peptide-YY (PYY) is a 36 amino acid peptide that is released postprandially from the distal gastrointestinal tract and it acts within the arcuate nucleus to inhibit the release of neuropeptide Y
- Infusion of PYY3–36 in humans induces satiety and reduces food intake
  - Recent studies have shown depressed PYY levels in morbidly obese individuals in comparison to lean controls and blunted response in PYY release after meal stimulation

- Elevated levels of PYY have been observed in various gastrointestinal diseases, such as chronic pancreatitis, tropical sprue, Crohn’s disease, and ulcerative colitis, which are associated with malabsorption due to abnormal delivery of undigested fat to the distal small bowel and decreased appetite

TABLE 3. Body Mass Index, % Excess Weight Loss, Ghrelin, and PYY Changes Before and 1, 3, 6, and 12 Months After Roux-en-Y Gastric Bypass

	Pre (mean ± SD)	1 mo (mean ± SD)	3 mo (mean ± SD)	6 mo (mean ± SD)	12 mo (mean ± SD)	*P*
Body mass index (kg/m^2)	46.6 ± 3.7	41.9 ± 3.2	38.0 ± 3.1	34.3 ± 2.8	31.5 ± 3.4	<0.001
EWL%		20.5 ± 7.8	35.2 ± 5.4	50.2 ± 6.5	60.5 ± 10.7	<0.001
Fasting ghrelin (pg/mL)	638 ± 189	550 ± 136	610 ± 188	636 ± 188	714 ± 230	0.19
Fasting PYY (pg/mL)	132 ± 38	165 ± 55	173 ± 51	223 ± 79	199 ± 55	<0.001

TABLE 4. Body Mass Index, % Excess Weight Loss, Ghrelin, and PYY Changes Before and 1, 3, 6, and 12 Months After Sleeve Gastrectomy

	Pre (mean ± SD)	1 mo (mean ± SD)	3 mo (mean ± SD)	6 mo (mean ± SD)	12 mo (mean ± SD)	*P*
Body mass index (kg/m^2)	45.1 ± 3.6	41 ± 3.5	36.8 ± 3.4	32 ± 2.9	28.9 ± 3.6	<0.001
EWL%		18.2 ± 6.0	36.7 ± 6.8	55.5 ± 7.6	69.7 ± 14.6	<0.001
Fasting ghrelin (pg/mL)	605 ± 185	364 ± 83	399 ± 135	398 ± 100	399 ± 97	<0.001
Fasting PYY (pg/mL)	124 ± 30	155 ± 57	139 ± 44	182 ± 44	204 d ± 91	0.001

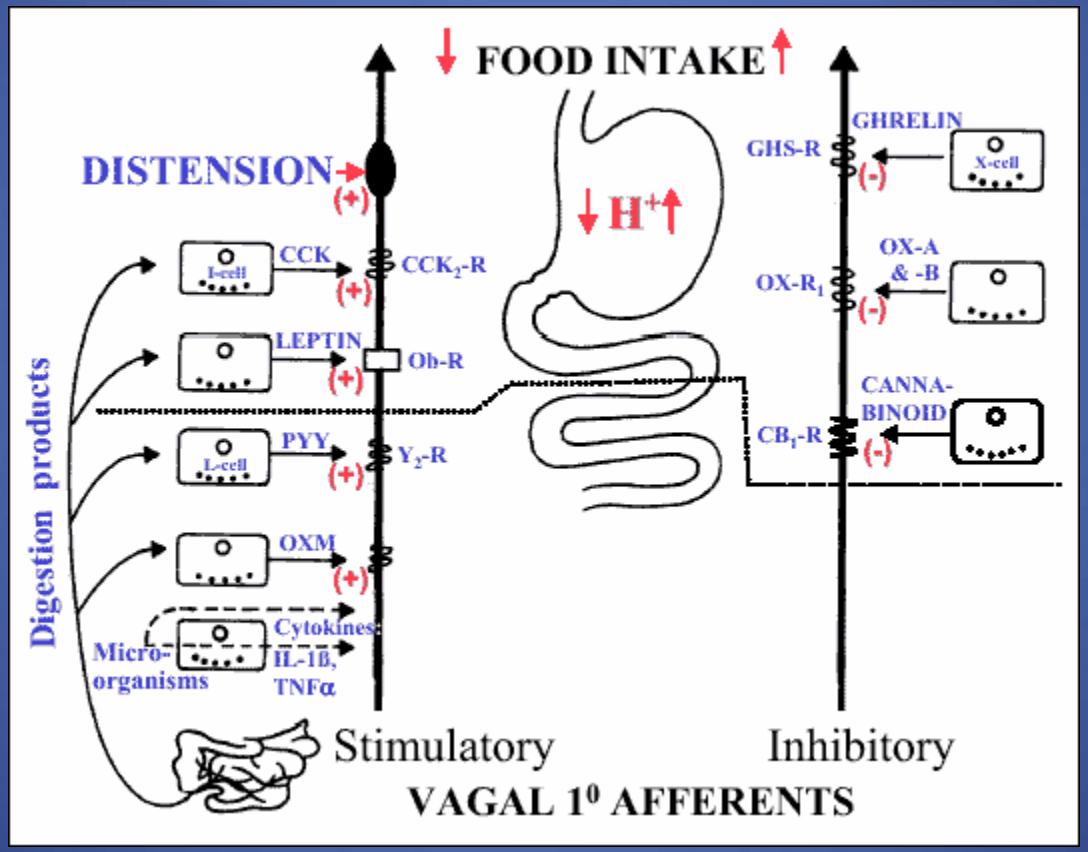
Leptin

- Human leptin is a protein of 167 amino acids that is manufactured primarily in the adipocytes of white adipose tissue

- The level of circulating leptin is directly proportional to the total amount of fat in the body

- Leptin acts on receptors in the hypothalamus of the brain where it inhibits appetite by:
  - counteracting the effects of nueropeptide Y: a potent feeding stimulant secreted by cells in the gut and in the hypothalamus
  - counteracting the effects of anandamide: a potent feeding stimulant that binds to the same receptors as THC
  - promoting the synthesis of alpha- MSH, an appetite suppressant

- Leptin inhibition is long-term
  - in contrast to the rapid inhibition of eating by cholecystokinin (CCK) and the slower suppression of hunger between meals mediated by PYY
- The absence of a leptin (or its receptor) leads to uncontrolled food intake and resulting obesity


FOOD INTAKE
DISTENSION
(+)
H+
GHRELIN
GHS-R
X-cell
(-)
OX-A
& -B
OX-R1
CCK
L-cell
CCK2-R
LEPTIN
Ob-R
CANNA-
BINOID
CB1-R
PYY
Y2-R
OXM
Digestion products
Micro-
organisms
Cytokines
IL-1ß,
TNFα
Stimulatory
Inhibitory
VAGAL 1⁰ AFFERENTS

Problems to be Solved

- High risk of endoluminal and/or extraluminal bleeding due to long length of staple line
  - Now routine oversewing of the staple line
  - Use of bovine pericardial strips over staple lines
- Staple line leaks
- Still requires a learning curve
- Decision regarding the “right” sleeve size

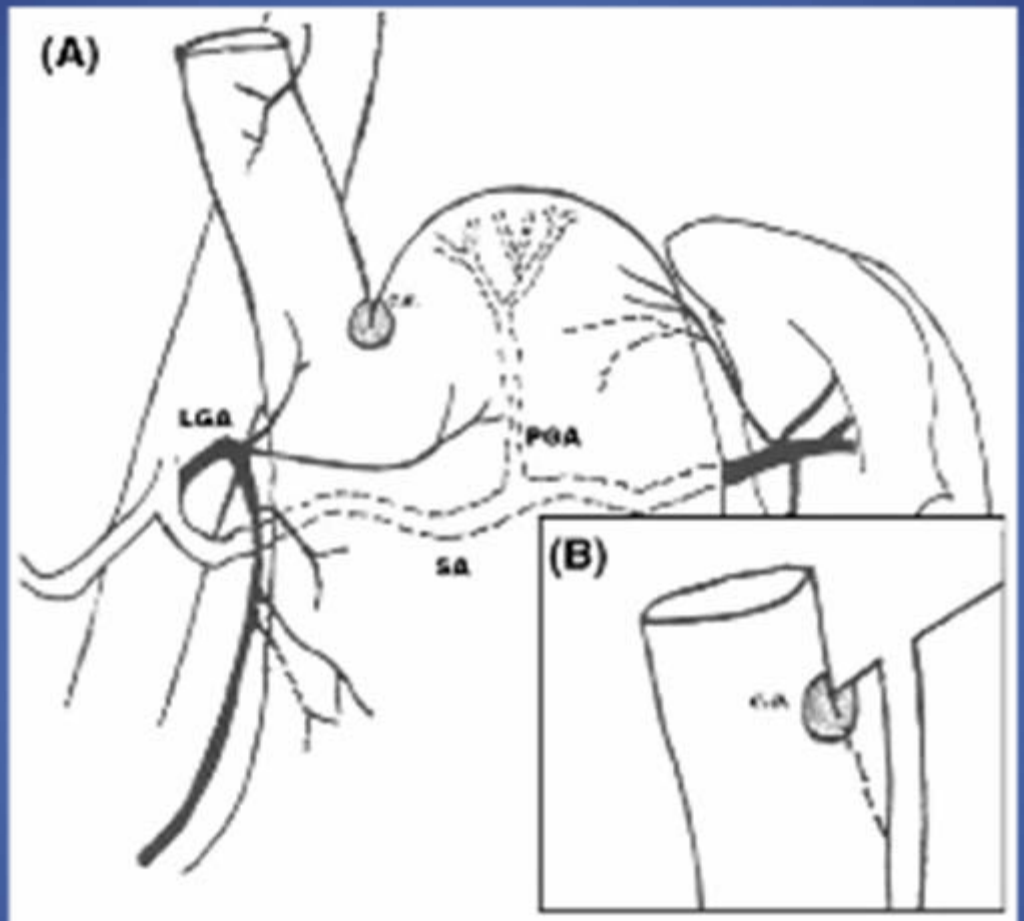


Fig. 4 **A** Vascularization of the cardias. LGA = left gastric artery; PGA = posterior gastric artery; SA = splenic artery; c.a. = critical area. **B** Leaving 1–2 cm of the gastric fundus at the esophagogastric junction the resection line avoids the "critical area" (c.a.)

Questions?

References

- **References**

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