Bariatric Surgery and Type 2 Diabetes

Dr. Robert Shawhan FACS

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Notice of Requirements for Successful Completion:

Learners must participate in the full activity and complete the evaluation in order to claim continuing education credit/hours.

Presenter(s) Conflicts of Interest/Financial Relationships Disclosures:

Dr. Robert Shawhan FACS - NONE

Disclosure of Relevant Financial Relationships and Mechanism to Identify and Mitigate Conflicts of Interest: No conflicts of interest

Non-Endorsement of Products: Accredited status does not imply endorsement by ADCES or Joint Accreditation of any commercial products displayed in conjunction with this educational activity

Off-label Use: NONE

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Disclosures

- None
- I work for Memorial Hospital of Converse County
- I don’t make more money by doing Bariatric Surgery

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Who am I

- Trained in the U.S. Army
- Graduated training in 2017
- Been doing Bariatric Surgery since
- Find it personally rewarding

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Outline

- History of Bariatric Surgery
- Types of Bariatric Surgery
- Effect on Type 2 Diabetes
- Patient Selection
- Mechanisms of glucose control
- Compared to GLP-1

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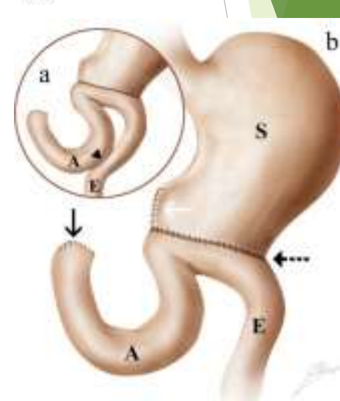
A Brief History

- Perforated Ulcers
- Noticed patients lost weight
- Comorbidity Reduction



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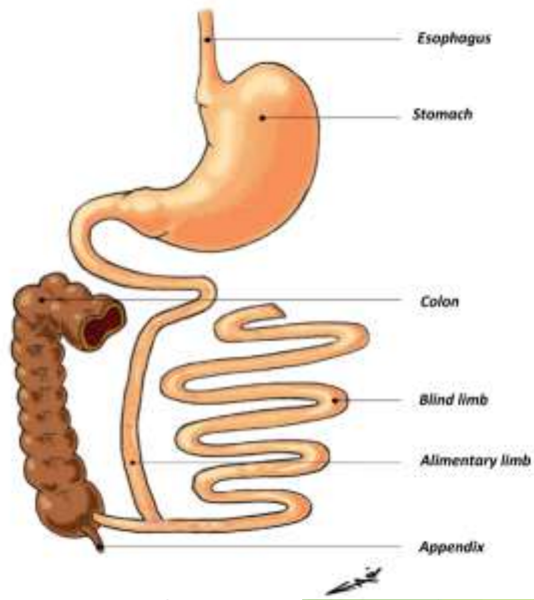
First Bariatric Surgery

- 1953 by Dr. Varco at the University of Minnesota
- Purely Malabsorptive
- Not nearly as common as today
  - Difficult patient population to operate
  - Obesity not as common



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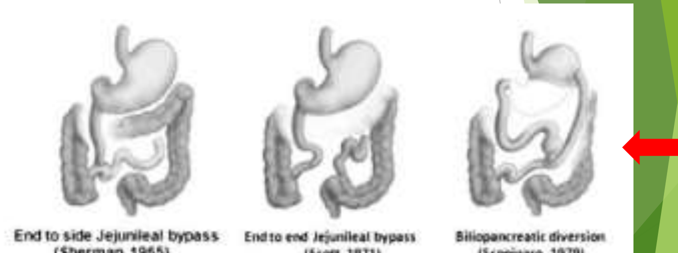
Evolution

- Did evolve over the years
- Slow
- Was not widely performed
- Balancing act between
  - Malabsorption
  - Liver failure
  - Diarrhea
  - Inadequate Weight loss



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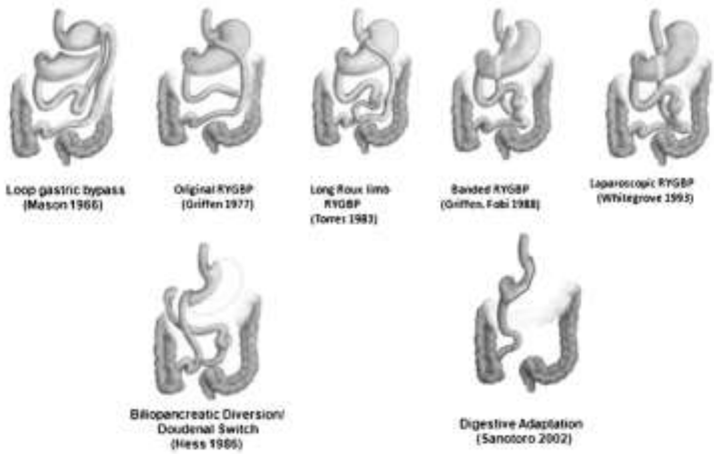
Started to see more modern day procedures evolve



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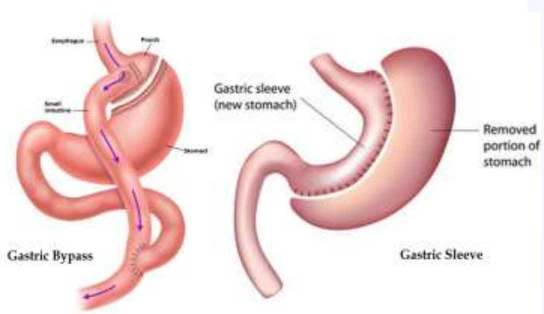
Bariatric surgery today



80% of surgeries done today

	2022	2021	2020	2019	2018	2017	2016
Sleeve	160,609	152,866	122,056	152,413	154,976	135,401	125,318
RYGB	62,097	56,527	41,280	45,744	42,945	40,574	40,316
Band	2,500	1,121	2,393	2,375	2,660	6,318	7,310
BPD-DS	6,096	5,525	3,555	2,272	2,123	1,588	1,236
Revision	30,894	31,021	22,022	42,881	38,971	32,238	30,077
SADI	1,567	1,025	488	—	—	—	—
OAGB	1,057	1,149	1,338	—	—	—	—
Other	6,189	7,339	1,221	6,060	5,847	5,606	5,665
ESG	4,600	2,220	1,500	—	—	—	—
Balloons	4,358	4,100	2,800	4,655	5,042	6,280	5,744
Total	279,967	262,893	198,651	256,000	252,564	228,005	215,666

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Effect on Diabetes

ANNALS OF SURGERY
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Who Would Have Thought It?

An Operation Proves to Be the Most Effective Therapy for Adult-Onset Diabetes Mellitus

Walter J. Pories, M.D., Melvin S. Swanson, Ph.D., Kenneth G. MacDonald, M.D., Stuart B. Long, B.S., Patricia G. Morris, B.S.N., Brenda M. Brown, M.R.A., Hisham A. Barakat, Ph.D., Richard A. deRamon, M.D., Gay Israel, Ed.D., Jeanette M. Dolezal, Ph.D., and Lynis Dohm, Ph.D.

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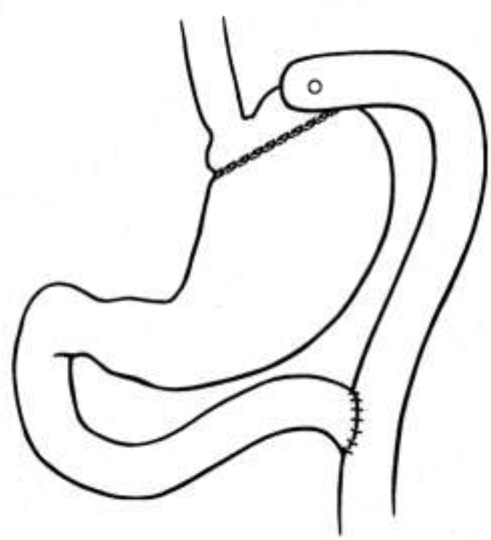
Study Outline

- Prospective study
- 608 patients; all got Gastric Bypass
  - 303 were noted to have Non-insulin dependent Diabetes or impaired glucose tolerance
- Followed over 14 years
- 97% percent follow up over 14 years

342 Pories and Others



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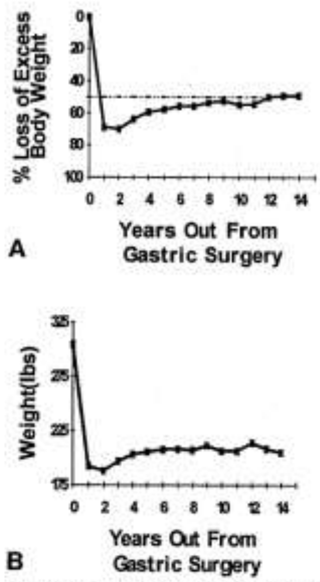
Weight Loss Effect



Year	n	std
0	608	0.0
1	506	17.8
2	407	20.9
3	383	23.6
4	337	24.7
5	317	25.3
6	290	24.0
7	271	24.0
8	229	23.0
9	216	22.3
10	158	21.3
11	106	22.5
12	81	24.3
13	38	22.1
14	10	23.9

Year	n	std
0	608	66
1	506	49
2	407	50
3	383	51
4	337	54
5	317	56
6	290	54
7	271	55
8	229	49
9	216	51
10	158	48
11	106	51
12	81	55
13	38	47
14	10	40

Figure 3. The gastric bypass produces durable weight loss. Weight loss of the entire cohort of 608 patients is shown in terms of pounds and percentage loss of excess body weight. If the patients with failed staple lines and stretched anastomoses are removed, the line is virtually straight.

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Effect on Glucose

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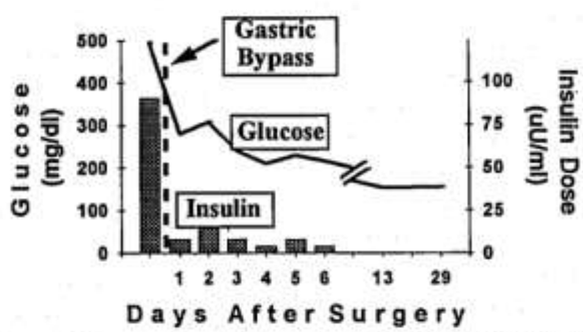

Figure 4. The correction of the hyperglycemia occurs rapidly. Patient 1 had an fasting blood glucose level of 495 mg/dL on the day before surgery despite the administration of 90 U of insulin. By the end of the 1st postoperative day, her fasting blood glucose level fell to 281 mg/dL and her insulin requirement dropped to 8 U. By the 6th postoperative day, she no longer required insulin.

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Effect on Glucose

- 298 patients with NIDDM and IGT(impaired glucose tolerance) had pre and post-op data (average 7.6 years)
- At the study Conclusion 271(91%) had normal fasting blood Glucose and HA1C
- 27(9%) continued to be Diabetic

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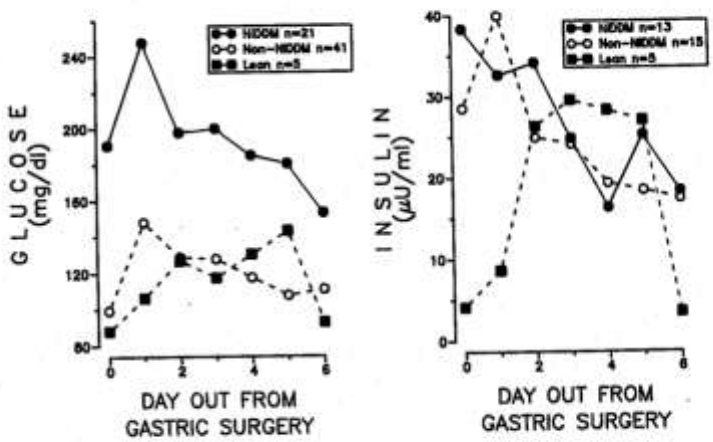
Figure 5. A comparison of blood glucose values and insulin levels after surgery in two cohorts, one with euglycemia and the other with NIDDM. The insulin and glucose levels rise slightly during the postoperative period in the euglycemic patients but fall sharply in those with NIDDM.



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Conclusions of the Study

- Gastric Bypass can control diabetes
- Can control it rapidly
- Can control it for a long time even if patient remain obese
- Some component of glucose control is independent of weight loss
  - Can't say exactly why
  - Diet?
  - Hormones?
  - Signaling?
  - All the above

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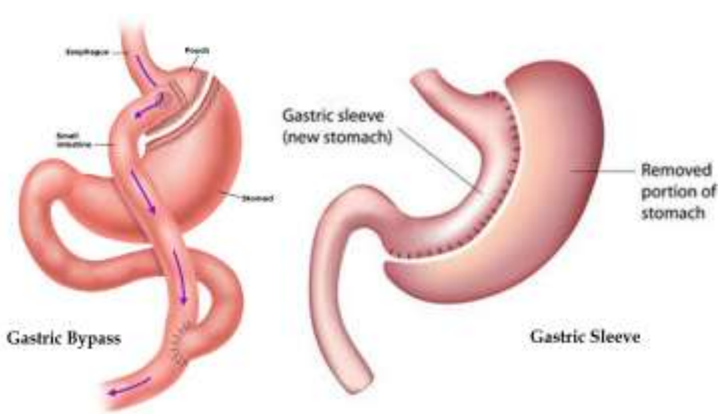
How effective is Metabolic surgery today?



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Stampede Trial

- First published in 2012
- 5 year follow up data 2017
- 150 patients; Randomized prospective
- 3 groups
  - Intensive medical therapy
  - Medical therapy plus Roux-en-y
  - Medical Therapy plus Sleeve
- All started with HA1C >7.0
- Primary outcome was HA1C<6.0 @ 12 months, initially. Looked at 2 year, and 5 year data.

ORIGINAL ARTICLE

Bariatric Surgery versus Intensive Medical Therapy for Diabetes — 5-Year Outcomes

Philip R. Schauer, M.D., Deepak L. Bhatt, M.D., M.P.H., John P. Kirwan, Ph.D., Kathy Wolski, M.P.H., Ali Aminian, M.D., Stacy A. Brethauer, M.D., Sankar D. Navaneethan, M.D., M.P.H., Rishi P. Singh, M.D., Claire E. Pothier, M.P.H., Steven E. Nissen, M.D., and Sangeeta R. Kashyap, M.D., for the STAMPEDE Investigators*

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Table 1. Characteristics of the Patients at Baseline.*

Characteristic	Medical Therapy (N=50)	Gastric Bypass (N=50)	Sleeve Gastrectomy (N=50)	P Value
Duration of diabetes — yr	8.9±5.8	8.2±5.5	8.5±4.8	0.72
Use of insulin — no. (%)	22 (44)	22 (44)	22 (44)	1.00
Age — yr	49.7±7.4	48.3±8.4	47.9±8.0	0.46
Female sex — no. (%)	31 (62)	29 (58)	39 (78)	0.08
Body-mass index†				
Value	36.8±3.0	37.0±3.3	36.2±3.9	0.42
<35 — no. (%)	19 (38)	14 (28)	18 (36)	0.54
Body weight — kg	106.5±14.7	106.7±14.8	100.8±16.4	0.10
Waist circumference — cm	114.5±9.4	116.4±9.2	114.0±10.4	0.43
Waist-to-hip ratio	0.95±0.09	0.96±0.07	0.96±0.09	0.88
White race — no. (%)‡	37 (74)	37 (74)	36 (72)	0.97
Smoker — no./total no. (%)	15/42 (36)	20/50 (40)	11/50 (22)	0.14
Metabolic syndrome — no. (%)	46 (92)	45 (90)	47 (94)	1.00
History of dyslipidemia — no./total no. (%)	36/43 (84)	44/50 (88)	40/50 (80)	0.55
History of hypertension — no./total no. (%)	26/43 (60)	35/50 (70)	30/50 (60)	0.51

* Plus–minus values are means ±SD. P values are for the overall comparisons.
† The body-mass index is the weight in kilograms divided by the square of the height in meters.
‡ Race was self-reported.

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Outcomes

- 9 patients withdrew prior to the study
  - 8 in the intensive medical therapy group
- 1 died during the 5 year follow up period
  - Medical therapy group from a myocardial infarction
- 6 Patients lost to follow up
- Left with 134 patients at 5 years (89%)

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Mean Changes % year in Measures of Diabetes Control from Baseline to 5 Years.

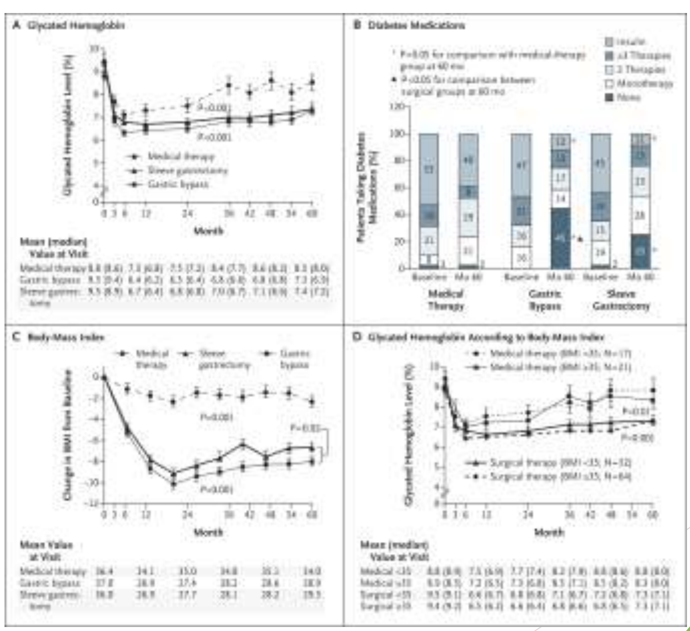

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Table 1. Primary and Secondary End Points at 5 Years.*

End Point	Study Group			P Value†		
	Medical Therapy (N=38)	Gastric Bypass (N=49)	Sleeve Gastrectomy (N=47)	Gastric Bypass vs. Medical Therapy	Sleeve Gastrectomy vs. Medical Therapy	Gastric Bypass vs. Sleeve Gastrectomy
Primary end point						
Glycated hemoglobin ≤6.0%						
In analysis of patients who completed the trial — no. of patients (%)	2 (5.3)‡	14 (28.6)	11 (23.4)	0.01 (unadjusted); 0.03 (adjusted)	0.03 (unadjusted); 0.07 (adjusted)	0.53 (unadjusted); 0.53 (adjusted)
Estimated rate from imputed analysis — %§	7.3	26.4	20.4	0.08	0.17	0.48
Secondary end points						
Glycated hemoglobin — no. of patients (%)						
≤6.0% without diabetes medications	0	11 (22.4)	7 (14.9)	0.006¶	0.04¶	0.34
≤6.5%	6 (15.8)	19 (38.8)	17 (36.2)	0.06	0.06	0.79
≤6.5% without diabetes medications	0	15 (30.6)	11 (23.4)	0.003‖	0.002‖	0.43
<7.0%	8 (21.1)	25 (51.0)	23 (48.9)	0.012	0.016	0.84
Glycated hemoglobin level — %						
At baseline	8.8±1.1	9.3±1.4	9.5±1.7			
At 5 yr	8.5±2.2	7.3±1.5	7.4±1.6			
Change from baseline	−0.3±2.0	−2.1±1.8	−2.1±2.3	0.003	0.003	0.67
Median fasting plasma glucose (IQR) — mg/dl						
At baseline	157 (120 to 193)	196 (143 to 231)	164 (129 to 229)			
At 5 yr	129 (97 to 172)	110 (92 to 150)	111 (93 to 141)			
Change from baseline‖	−14 (−60 to 23)	−72 (−114 to −29)	−49 (−120 to −4)	0.003	0.02	0.35

Conclusion: Surgery is better then medical therapy alone in decreasing and resolving hyperglycemia.

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Patient Selection

- Patients with BMI > 35
- Patients with T2D BMI > 30
- Patients with BMI > 30 with co-morbidity

Original article

2022 American Society for Metabolic and Bariatric Surgery (ASMBS) and International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO): Indications for Metabolic and Bariatric Surgery

Dan Eisenberg, M.D., Scott A. Shikora, M.D., Edo Aarts, M.D., Ph.D., Ali Aminian, M.D., Luigi Angrisani, M.D., Ricardo V. Cohen, M.D., Ph.D., Maurizio De Luca, M.D., Silvia L. Faria, Ph.D., Kasey P. S. Goodpaster, Ph.D., Ashraf Haddad, M.D., Jacques M. Himpens, M.D., Ph.D., Lilian Kow, B.M.B.S., Ph.D., Marina Kurian, M.D., Ken Loi, M.B.B.S., B.Sc. (Med), Kamal Mahawar, M.B.B.S., M.Sc., Abdelrahman Nimeri, M.D., M.B.B.Ch., Mary O'Kane, M.Sc., R.D., Pavlos K. Papasavas, M.D., Jaime Ponce, M.D., Janey S. A. Pratt, M.D., Ann M. Rogers, M.D., Kimberley E. Steele, M.D., Ph.D., Michel Suter, M.D., Shanu N. Kothari, M.D.

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Can we tell which patients with Diabetes will benefit most from Surgery?

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RESEARCH ARTICLE

Duration of type 2 diabetes and remission rates after bariatric surgery in Sweden 2007–2015: A registry-based cohort study

Anders Jans[1], Ingmar Näslund[1], Johan Ottosson[1], Eva Szabo[1], Erik Näslund[2], Erik Stenberg[1]*

1 Department of Surgery, Faculty of Medicine and Health, Örebro University, Örebro, Sweden, 2 Division of Surgery, Department of Clinical Sciences, Danderyd Hospital, Karolinska Institutet, Stockholm, Sweden

- Retrospective review of a prospective database
- 8,546 patients were included
- Everyone that had Bariatric Surgery in Sweden

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Patient population

- Included Sleeve gastrectomy (434) and Gastric Bypass (8,112) patients

- 4,192(49.1%) on oral medication
- 1,973(23.1%) oral med and insulin
- 1,914(22.5%) non-pharmacologic
- 453(5.3%) on insulin
- 14(0.2%) GLP-1

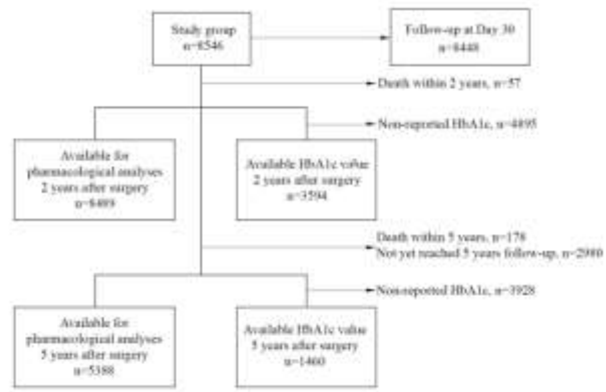

Fig 1. Study flowchart describing availability for analyses.

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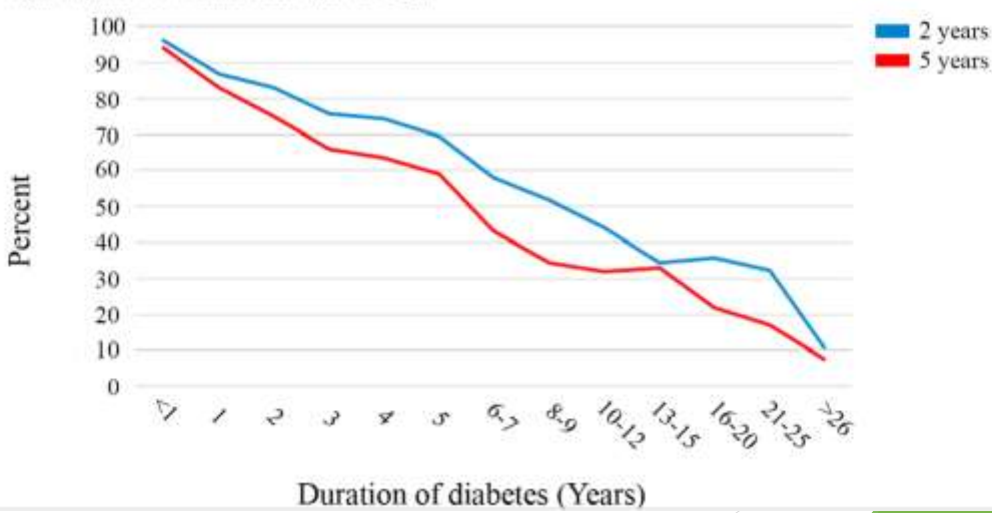
Duration of type 2 diabetes and remission rates after bariatric surgery in Sweden 2007–2015: A registry-based cohort study

Fig 2

Proportion of patients free from medication at 2 and 5 years after surgery



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Duration of type 2 diabetes and remission rates after bariatric surgery in Sweden 2007–2015: A registry-based cohort study

Table 2

Numbers free from medical treatment 2 and 5 years after surgery

Diabetes duration, years	*n* (%) free from medical treatment at follow-up	
	2 years	5 years
<1	2,473 (96.1%)	1,535 (94.2%)
1	899 (86.7%)	553 (83.0%)
2	674 (82.9%)	404 (75.0%)
3	549 (75.6%)	322 (66.1%)
4	437 (74.3%)	252 (62.6%)
5	407 (69.3%)	252 (59.0%)
6–7	469 (58.0%)	223 (43.0%)
8–9	270 (51.5%)	95 (34.5%)
10–12	187 (44.0%)	76 (32.1%)
13–15	61 (34.3%)	29 (33.0%)
16–20	49 (35.8%)	17 (22.1%)
21–25	21 (32.3%)	6 (17.1%)
≥26	3 (10.7%)	1 (7.7%)

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Other Variables linked to diabetes remission

- Lower base line HA1C
- Younger age
- Not using insulin
- Higher pre-op BMI
- Higher excess BMI loss
- Male Sex

Duration of type 2 diabetes and remission rates after bariatric surgery in Sweden 2007–2015: A registry-based cohort study

Table 3

Odds ratios (ORs) for reaching complete diabetes remission 2 years after surgery

Characteristic	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[1]	Adjusted *p*-Value[1]
Preoperative diabetes duration	0.78 (0.76–0.79)	0.87 (0.85–0.89)	<0.001
Baseline HbA1c	0.96 (0.95–0.97)	0.98 (0.97–0.98)	<0.001
Insulin treatment at baseline	0.15 (0.12–0.16)	0.25 (0.20–0.31)	<0.001
Percentage excess BMI loss	1.02 (1.01–1.02)	1.03 (1.02–1.03)	<0.001
Age	0.94 (0.93–0.95)	0.94 (0.93–0.95)	<0.001
Preoperative BMI	1.06 (1.06–1.07)	1.07 (1.05–1.09)	<0.001
Sex			
Female	Reference	Reference	Reference
Male	0.89 (0.77–1.02)	1.57 (1.29–1.90)	<0.001
Education			
Primary education (≤9 years)	0.77 (0.65–0.92)	0.96 (0.76–1.22)	0.747
Secondary education (10–12 years)	Reference	Reference	Reference
Higher education ≤3 years	1.07 (0.86–1.34)	1.15 (0.86–1.55)	0.353
Higher education >3 years	1.27 (1.03–1.60)	1.26 (0.94–1.70)	0.126
Surgical method			
Gastric bypass	Reference	Reference	Reference
Sleeve gastrectomy	0.64 (0.47–0.88)	0.72 (0.48–1.10)	0.129

[1]Multivariable logistic regression including all factors listed in the table.

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How does Bariatric Surgery work?

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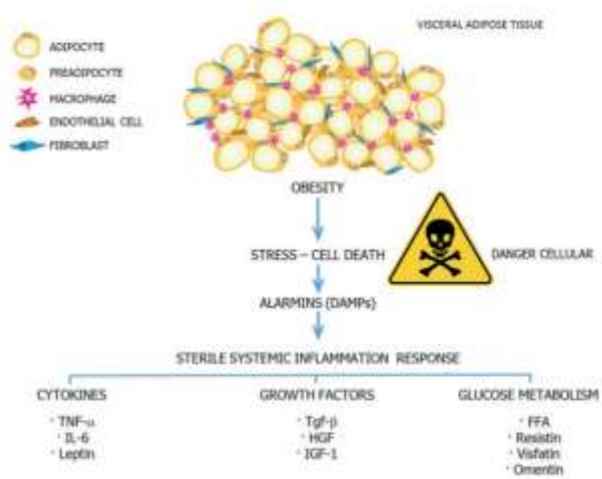

Fig. 1. *Schematic representation of the immunometabolic response in obesity. Obesity leads to the induction of inflammatory signaling pathways. TNF-α: tumor necrosis factor-α; IL-6: interleukin-6; TGF-β: transforming growth factor-β; IGF-1: insulin growth factor; DAMPs: damage associated*

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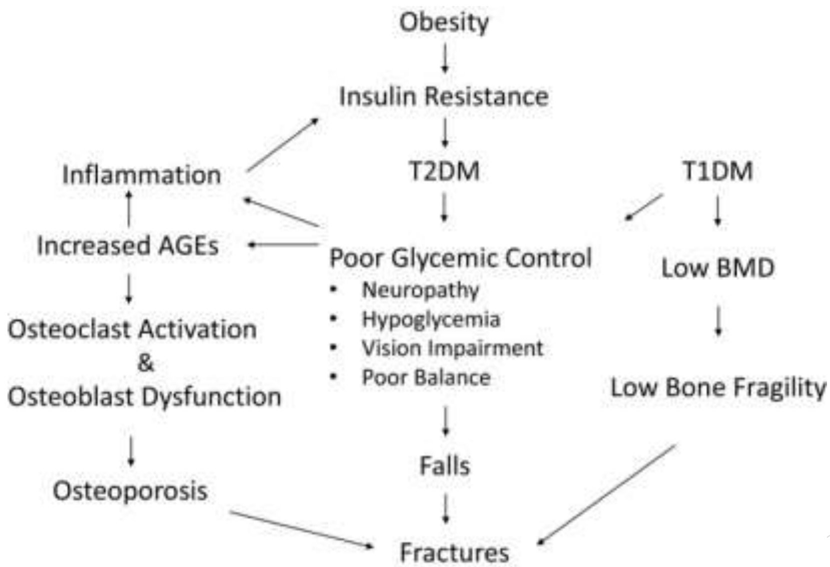

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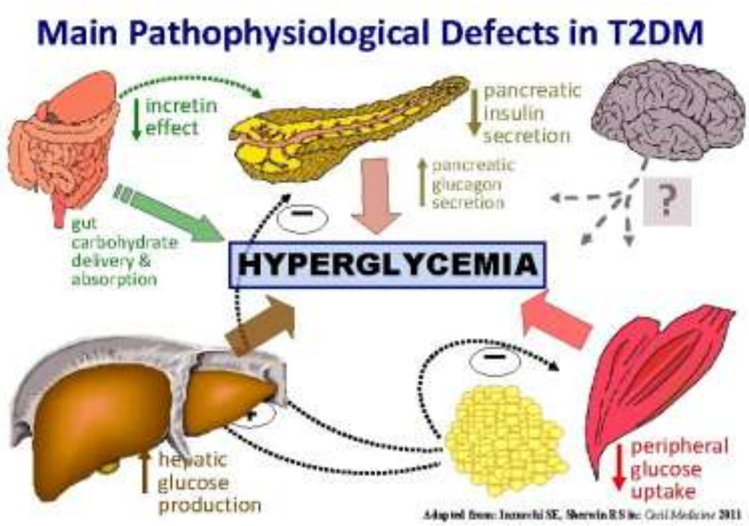
Pathophysiology of type 2 Diabetes



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Mechanisms

- Weight Loss Dependent
- Weight Loss independent

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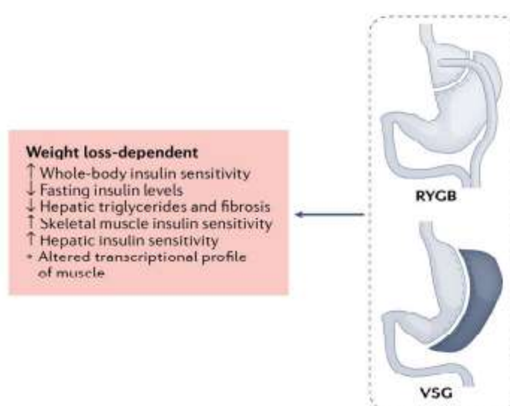
Weight Loss Dependent

- Total Adipose Tissue Loss
- Reduces Intrahepatic Lipids
- Improve Insulin Sensitivity
- Overall Glucose Metabolism



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There's more to the picture

- Glycemic control is rapid
  - Off medications and insulin before they leave the hospital
  - Given the same diet patients with bariatric surgery lose weight faster

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Table 1.

Effects of RYGB, SG and diet-induced weight loss on incretins and hormones

	RYGB	SG	Diet-Induced Weight Loss
Ghrelin	↓	↔ ↓	↑
PYY	↑	↑	↓
GLP-1	↑	↑	↔
GIP	↑ ↔	↑ ↔	↑ ↔
CCK	↑	↑	↓
Insulin	↑	↑	↓
Leptin	↓	↓	↓
Adiponectin	↑	↑	↑
Estrogen	↓	↓	—

Levels of GLP-1 and PYY rise after both RYGB and SG and not in diet-induced weight loss. Ghrelin levels decrease markedly after SG and increase after diet-induced weight loss. There are conflicting data regarding the change of GIP after surgical and diet-induced weight loss and ghrelin levels after RYGB. While estrogen reduction is associated with surgical weight loss and exercise-induced weight loss it does not significantly change in diet-induced weight loss.

↓ Decreased, ↑ Increased, ↔ Conflicting data, - No change.

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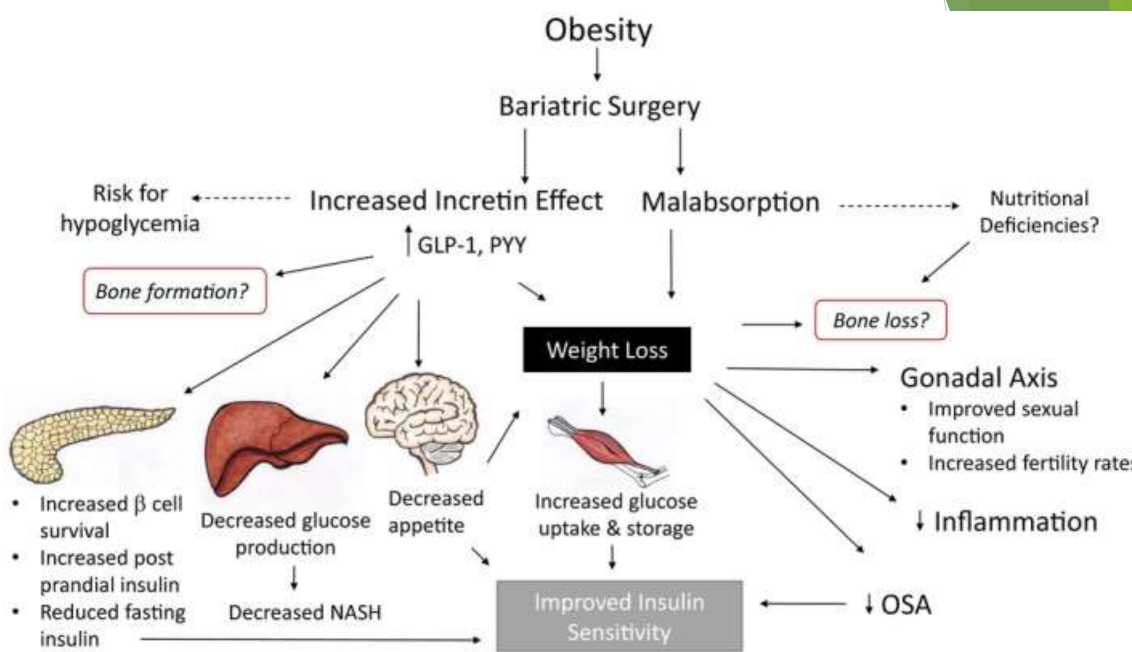
Obesity
Bariatric Surgery
Risk for hypoglycemia
Increased Incretin Effect
Malabsorption
Nutritional Deficiencies?
↑GLP-1, PYY
Bone formation?
Bone loss?
Weight Loss
Gonadal Axis
• Improved sexual function
• Increased fertility rates
↓ Inflammation
• Increased β cell survival
• Increased post prandial insulin
• Reduced fasting insulin
Decreased glucose production
Decreased NASH
Decreased appetite
Increased glucose uptake & storage
Improved Insulin Sensitivity
↓ OSA

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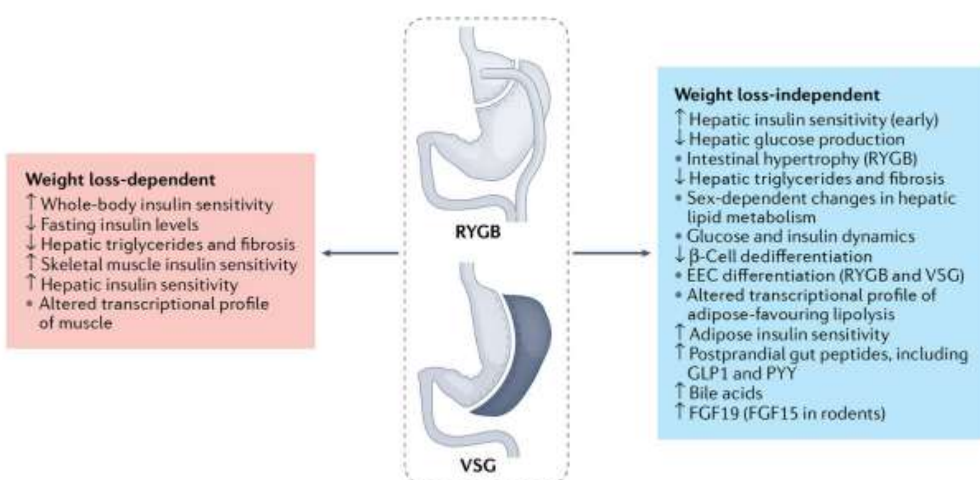
Weight loss-dependent
↑ Whole-body insulin sensitivity
↓ Fasting insulin levels
↓ Hepatic triglycerides and fibrosis
↑ Skeletal muscle insulin sensitivity
↑ Hepatic insulin sensitivity
• Altered transcriptional profile of muscle
RYGB
VSG
Weight loss-independent
↑ Hepatic insulin sensitivity (early)
↓ Hepatic glucose production
• Intestinal hypertrophy (RYGB)
↓ Hepatic triglycerides and fibrosis
• Sex-dependent changes in hepatic lipid metabolism
• Glucose and insulin dynamics
↓ β-Cell dedifferentiation
• EEC differentiation (RYGB and VSG)
• Altered transcriptional profile of adipose-favouring lipolysis
↑ Adipose insulin sensitivity
↑ Postprandial gut peptides, including GLP1 and PYY
↑ Bile acids
↑ FGF19 (FGF15 in rodents)

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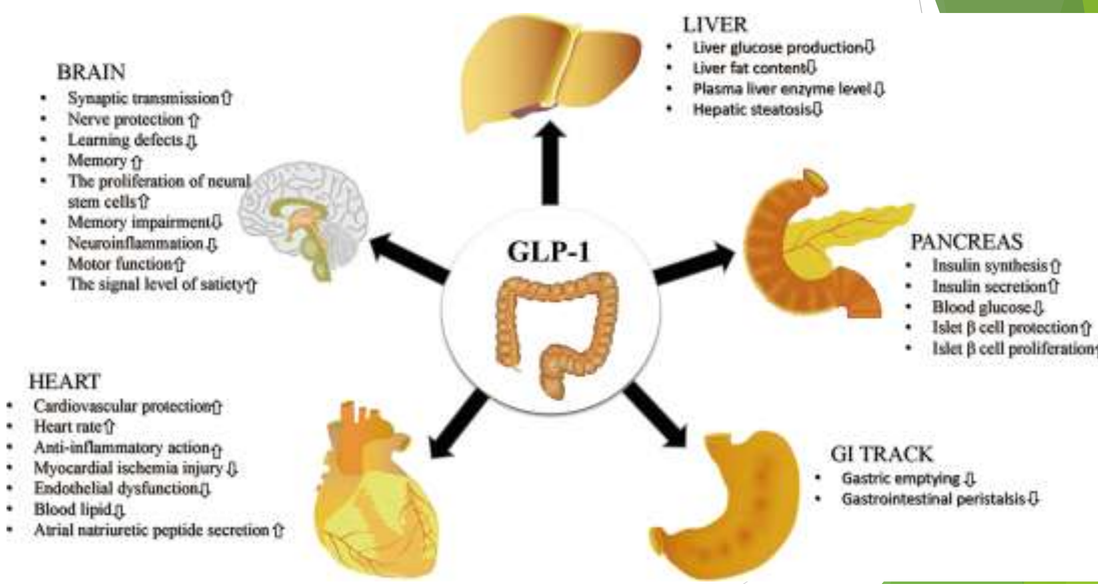
GLP-1



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Ozempic

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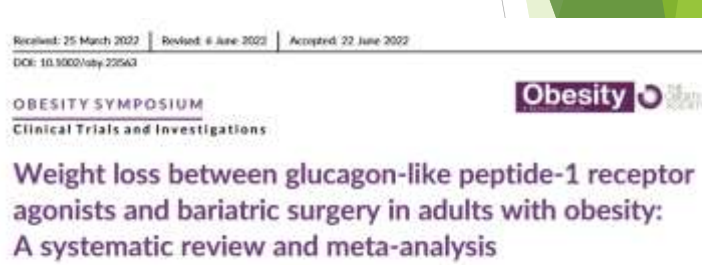
Set it and forget it

Head to Head Comparison

- Design
  - Meta-analysis
  - Primary end point was weight loss
  - Also looked at change in HA1C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Obesity

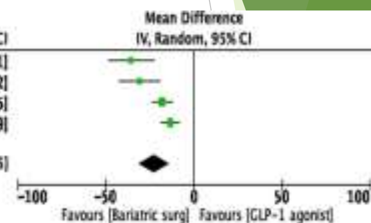
OBESITY SYMPOSIUM
Clinical Trials and Investigations

Weight loss between glucagon-like peptide-1 receptor agonists and bariatric surgery in adults with obesity: A systematic review and meta-analysis

Weight loss between glucagon-like peptide-1 receptor agonists and bariatric surgery in adults with obesity: A systematic review and meta-analysis

Study or Subgroup	GLP-1 agonist Mean	SD	Total	Bariatric surgery Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Mingrone 2021 BPD vs med	6.5	12.9	8	42.2	21.5	20	19.3%	−35.70 [−48.69, −22.71]
Mingrone 2021 gastric bypass vs med	6.5	12.9	7	37.3	14.5	20	21.3%	−30.80 [−42.28, −19.32]
Schauer 2017 gastric bypass vs med	5.3	10.8	19	23.2	9.6	49	29.6%	−17.90 [−23.45, −12.35]
Schauer 2017 sleeve gastrectomy vs med	5.3	10.8	19	18.6	7.5	47	29.9%	−13.30 [−18.61, −7.99]
Total (95% CI)			53			136	100.0%	−22.71 [−31.47, −13.95]

Heterogeneity: $Tau^2 = 59.53$; $Chi^2 = 14.88$, df = 3 ($P = 0.002$); $I^2 = 80\%$
Test for overall effect: Z = 5.08 ($P < 0.00001$)



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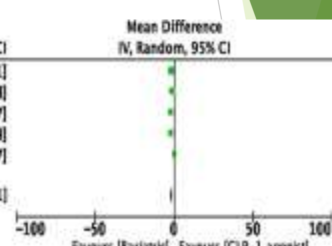
Weight loss between glucagon-like peptide-1 receptor agonists and bariatric surgery in adults with obesity: A systematic review and meta-analysis

Study or Subgroup	GLP-1 agonist Mean	SD	Total	Bariatric surgery Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Mingrone 2021 BPD vs med	0.8	1	8	2.4	1.6	20	21.9%	−1.60 [−2.59, −0.61]
Mingrone 2021 gastric bypass vs med	0.8	1	7	1.9	1.6	20	21.2%	−1.10 [−2.12, −0.08]
Schauer 2017 gastric bypass vs med	0.3	2	19	2.1	1.8	49	21.0%	−1.80 [−2.83, −0.77]
Schauer 2017 sleeve gastrectomy vs med	0.3	2	19	2.1	2.3	47	19.3%	−1.80 [−2.91, −0.69]
Valderas 2016	1.7	1.6	9	1.5	1.1	9	16.6%	0.20 [−1.07, 1.47]
Total (95% CI)			62			145	100.0%	−1.28 [−1.94, −0.61]

Heterogeneity: $Tau^2 = 0.27$; $Chi^2 = 7.55$, df = 4 ($P = 0.11$); $I^2 = 47\%$
Test for overall effect: Z = 3.78 ($P = 0.0002$)



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JAMA Network Open

Original Investigation | Diabetes and Endocrinology

Bariatric Metabolic Surgery vs Glucagon-Like Peptide-1 Receptor Agonists and Mortality

Dror Dicker, MD; Yael Wolff Sagy, PhD; Noga Ramot, BSc; Erez Battat, MBA; Philip Greenland, MD; Ronen Arbel, PhD; Gil Lavie, MD; Orna Reges, PhD

- Retrospective cohort
  - Primary endpoint is mortality
  - On patients with DM and obesity and no history of CVD

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JAMA Network

From: **Bariatric Metabolic Surgery vs Glucagon-Like Peptide-1 Receptor Agonists and Mortality**

Table 2. Differences in Outcomes Between Patients Who Underwent BMS and Matched Patients Who Were Treated With GLP-1RAs

Outcome	Diabetes diagnosis ≤10 y (n = 4742)			Diabetes diagnosis >10 y (n = 1328)		
	BMS (n=2371)	GLP-1RAs (n=2371)	P value	BMS (n=664)	GLP-1RAs (n=664)	P value
Duration of follow-up, y						
Mean (SD)	6.7 (3.2)	6.4 (3.3)	.005	6.9 (3.8)	7.4 (3.1)	.005
All-cause mortality, No. (%)	42 (1.8)	119 (5.0)	<.001	32 (4.8)	56 (8.4)	.01
Nonfatal MACEs, No. (%)	89 (2.8)	109 (4.6)	.002	53 (7.7)	58 (8.7)	.48
BMI at index date						
Mean (SD)	41.7 (5.0)	41.4 (5.3)	.11	40.7 (5.1)	40.4 (5.1)	.22
BMI maximal change, mean (SD)[a]						
Absolute change	−13.1 (4.0)	−5.3 (4.1)	<.001	−11.8 (4.8)	−5.2 (3.7)	<.001
Change from baseline, %	−31.4	−12.8		−29.0	−12.8	
BMI long-term change, mean (SD)[b]						
Absolute change	−10.1 (5.4)	−3.1 (4.3)	<.001	−8.8 (5.1)	−2.8 (4.2)	<.001
Change from baseline, %	−24.2	−7.5		−21.9	−7.2	
Hemoglobin A_{1c} level at index date, %						
Mean (SD)	7.2 (1.4)	8.0 (1.7)	<.001	8.0 (1.7)	[illegible]	<.001
Hemoglobin A_{1c} level maximal change, mean (SD), %[a]						
Absolute change, %	−1.8 (1.4)	−2.5 (1.7)	<.001	−2.0 (1.5)	−2.5 (1.6)	<.001
Hemoglobin A_{1c} long-term change, mean (SD), %[b]						
Absolute change, %	−1.2 (1.5)	−1.3 (2.1)	.20	−1.8 (1.8)	−1.5 (1.0)	<.001

Differences in Outcomes Between Patients Who Underwent BMS and Matched Patients Who Were Treated With GLP-1RAsAbbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); BMS, bariatric metabolic surgery; GLP-1RA, glucagon-like peptide-1 receptor agonist; MACE, major adverse cardiovascular event.

SI conversion factor: To convert hemoglobin A1c to proportion of total hemoglobin, multiply by 0.01.

[a] Maximal change was calculated as the difference between the level at the index date and the lowest level achieved during the follow-up period.

[b] Long-term change was calculated as the difference between the level at the index date and the most recent level achieved during the follow-up period.

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Barriers to GLP-1

- Cost
- Insurance approval
- Weight regain once stopped
- Side effects
- Sarcopenia
- Does not work for everyone

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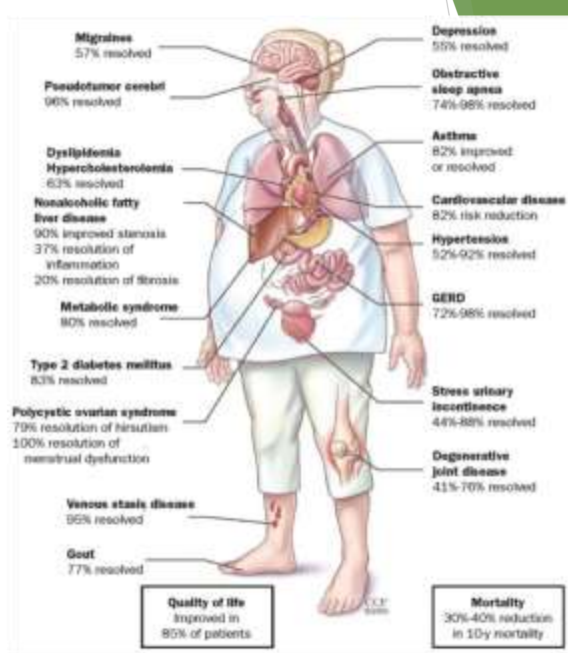
Bariatric surgery and other Co-morbidities



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Who is a good candidate for Bariatric Surgery vs GLP-1

- Overall Health?
- What are their Goals?
- What have they tried?

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MEMORIAL HOSPITAL of CONVERSE COUNTY

BARIATRIC SURGERY PATHWAY

NAME: ______________ AGE: ______

E-MAIL: ______________ PHONE: ______

PCM: ______________ WT: ____ BMI: ____

PRE-SURGICAL CHECKLIST

- ☐ INITIAL BARIATRIC VISIT — DATE: ______
  - ☐ OSA SCREENING — DATE: ______
  - ☐ CANCER SCREENING
    - [illegible] — DATE: ______
    - [illegible] — DATE: ______
    - [illegible] — DATE: ______
  - ○ EKG [illegible] — DATE: ______
- ☐ UPPER GI ASSESMENT (EGD/UGI) — DATE: ______
- ☐ PSYCHOLOGY APPOINTMENT — DATE: ______
- ☐ BARIATRIC LABS — DATE: ______
- ☐ NUTRITION VISIT — DATE: ______
- ☐ BIRTH CONTROL — 1ST: ______ 2ND: ______
- ☐ PRE-OP CLASS — DATE: ______
- ☐ PRE-OP WITH SURGEON — DATE: ______

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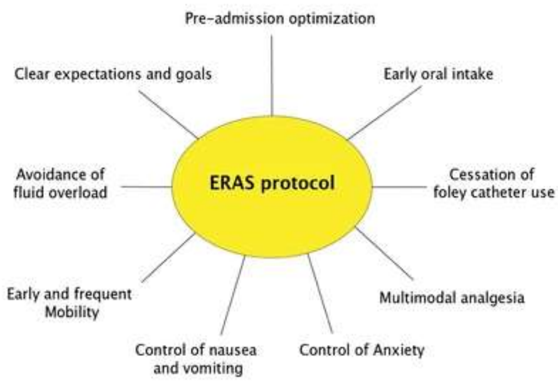
Advances in Peri-operative Care



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Conclusions

- Bariatric Surgery is a powerful tool for control of type 2 diabetes
- Best tool we have to control type 2 diabetes, reduce BMI, and control other health problems
- Not going away

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Future

- Pre or post op usage of GLP-1
- Newer and better drugs
- Study GLP-1s in large populations
- Compare outcomes for other co-morbidities

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