PODEN ARRIBAR A LA REMISSIÓ DE LA DM2 I FINS QUAN?

CIRURGIA

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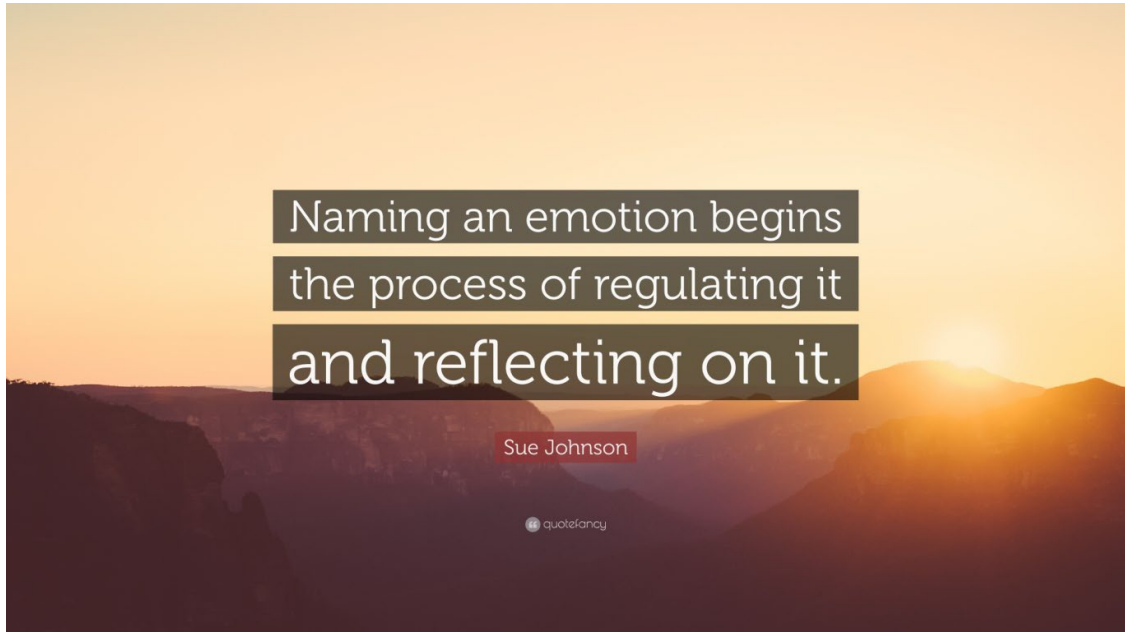
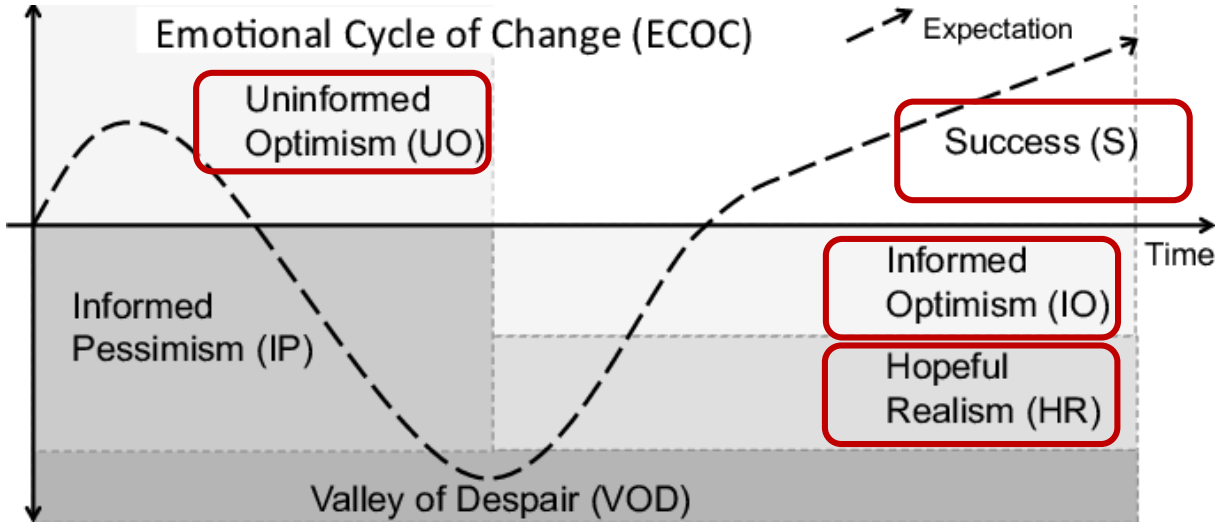
Bariatric surgery and diabetes remission: Who would have thought it?





Bariatric surgery and diabetes remission: Who would have thought it?

Table 1: Indication of bariatric surgery

Guidelines	Year	Indication
NIH	1991	Patients with BMI ≥40 kg/m^2 or patients with a serious co-morbidities and BMI ≥35 kg/m^2
Asia-pacific	2005	Patients with BMI >37 kg/m^2 Patients with BMI >32 kg/m^2 with T2DM or ≥2 co-morbidities
IFSO-APC	2011	Patients with BMI >35 kg/m^2 Patients with BMI >30 kg/m^2 with T2DM or metabolic syndrome
IDF	2011	Asian patients with BMI 27.5-32.5 kg/m^2 and T2DM not controlled by medical treatment in presence of CV risk factor

NIH: National Institute of Health, IFSO-APC: International Federation for the Surgery of Obesity and Metabolic Disorders Asia Pacific, IDF: International Diabetes Federation, BMI: Body mass index, T2DM: Type 2 diabetes

Table 2: Observational studies showing diabetes remission after bariatric surgery

Author, year	Country	*n*	Study type	Follow-up (month)	Bariatric surgery	T2DM remission rate (%)		*P*
						Bariatric	Conventiona	
Sjostrom *et al*., 2004	Sweden	3505	nRCT	24;120	LAGB-19% VBG-68% RYGB-13%	72	21	<0.001
Hofsø *et al*., 2010	Norway	146	nRCT	12	RYGB	79	0	<0.005
Adams *et al*., 2010	USA	816	nRCT	24	RYGB	78.7	2.6	<0.001
Serrot *et al*., 2011	USA	34	Retrospective	12	RYGB	64.7	0	<0.001
Martins *et al*., 2011	Norway	179	Prospective	12	RYGB	67	36.8	0.17
Iaconelli *et al*., 2011	Italy	50	Prospective	12–120	BPD	100	45	<0.001
Scopinaro *et al*., 2011	Italy	68	Prospective	12	BPD	83	0	<0.001
Leonetti *et al*., 2012	Italy	60	Prospective	3; 6; 12; 18	LSG	80	0	<0.001
Heo *et al*., 2012	Korea	485	Retrospective	18	RYGB-28% LAGB-27.6% LSG-44.4%	57.1	9.5	<0.001
Dorman *et al*., 2012	USA	58	Retrospective	12	RYGB-60.1% LAGB-20.9% DS-18.8%	65	3.4	<0.001
Leslie *et al*., 2012	USA	267	Prospective	24	RYGB	38.2	17.4	<0.001

nRCT: Nonrandomized controlled trial, T2DM: Type 2 diabetes mellitus, RYGB: Roux-en-Y gastric bypass, LSG: Laparoscopic sleeve gastrectomy, LAGB: Laparoscopic adjustable gastric banding, BPD: Biliopancreatic diversion, DS: Duodenal switch, VBG: Vertical banded gastroplasty

Singh et al, Indian Journal of Endocrinology, 2015

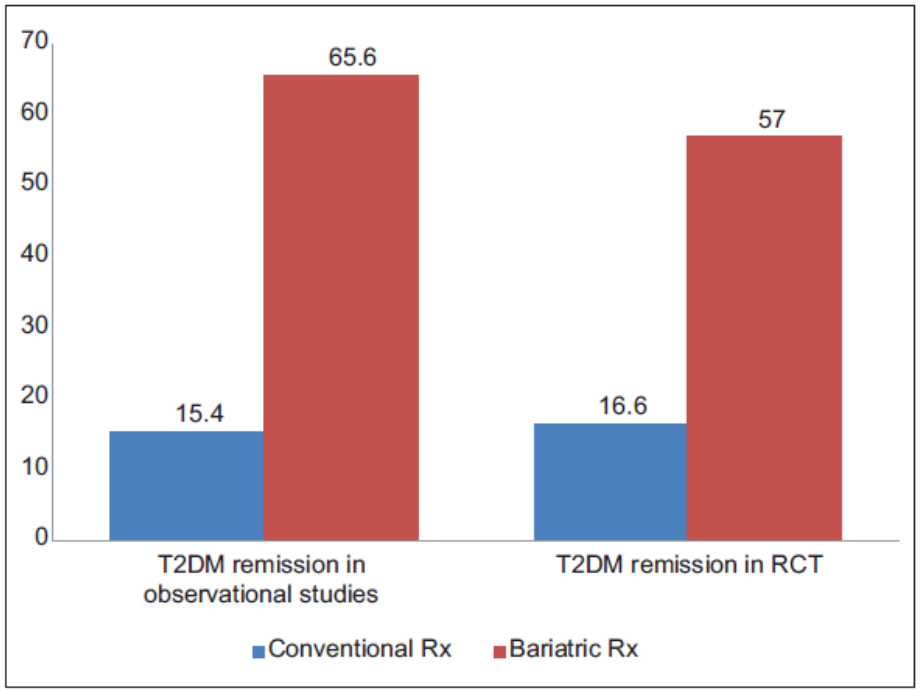


Figure 1: Type 2 diabetes mellitus remission rate (%) following bariatric surgery

Table 7: Meta-analysis: Diabetes remission following bariatric surgery in patients with BMI <35 kg/m²

Study, year	Number of patients (study included)	Remission rate	Remission criteria
Fried *et al*., 2010	343 (16 studies)	85%	HbA1c <6% at 0.5-1.5 year
Li *et al*., 2012	357 (13 studies)	80%	HbA1c <7% at 0.5 year and HbA1c <6% at 18th year
Reis *et al*., 2012	1209 (29 studies)	55%, (RYGB-70%, MGB –72%)	HbA1c <6% at 1-year (1.7% had similar or worse glycemic control)

RYGB: Roux-en-Y gastric bypass, MGB: Mini gastric bypass, HbA1c: Glycated hemoglobin

The NEW ENGLAND JOURNAL of MEDICINE

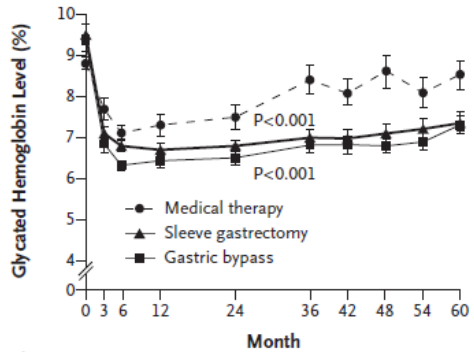
ORIGINAL ARTICLE

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*

N ENGL J MED 376;7 NEJM.ORG FEBRUARY 16, 2017

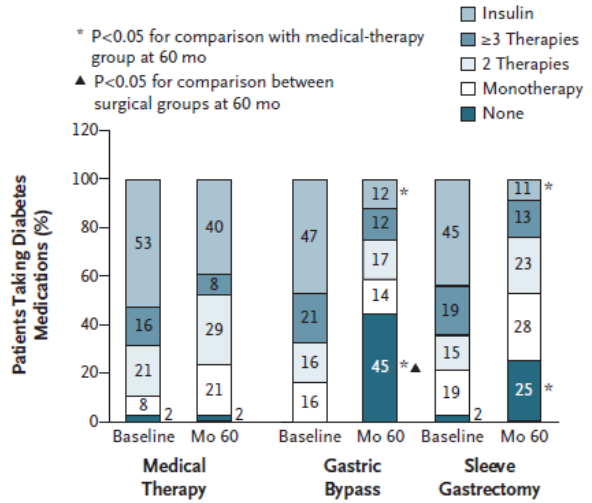
A Glycated Hemoglobin



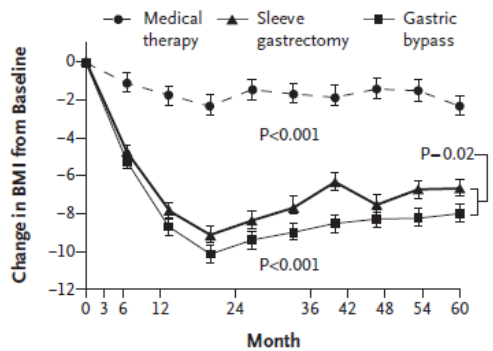
Mean (median) Value at Visit

Medical therapy	8.8 (8.6)	7.3 (6.8)	7.5 (7.2)	8.4 (7.7)	8.6 (8.2)	8.5 (8.0)
Gastric bypass	9.3 (9.4)	6.4 (6.2)	6.5 (6.4)	6.8 (6.6)	6.8 (6.8)	7.3 (6.9)
Sleeve gastrectomy	9.5 (8.9)	6.7 (6.4)	6.8 (6.8)	7.0 (6.7)	7.1 (6.6)	7.4 (7.2)

B Diabetes Medications



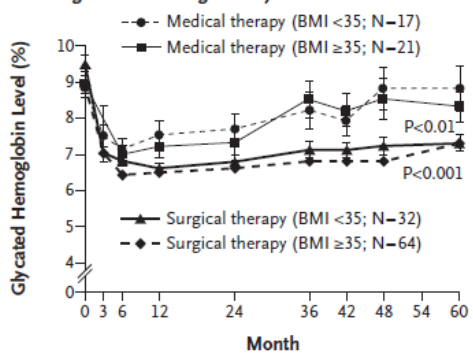
C Body-Mass Index



Mean Value at Visit

Medical therapy	36.4	34.1	35.0	34.8	35.1	34.0
Gastric bypass	37.0	26.9	27.4	28.2	28.6	28.9
Sleeve gastrectomy	36.0	26.9	27.7	28.1	28.2	29.3

D Glycated Hemoglobin According to Body-Mass Index



Mean (median) Value at Visit

Medical <35	8.8 (8.9)	7.5 (6.9)	7.7 (7.4)	8.2 (7.9)	8.8 (8.6)	8.8 (8.0)
Medical ≥35	8.9 (8.5)	7.2 (6.5)	7.3 (6.8)	8.5 (7.1)	8.5 (8.2)	8.3 (8.0)
Surgical <35	9.5 (9.1)	6.6 (6.7)	6.8 (6.8)	7.1 (6.7)	7.2 (6.8)	7.3 (7.1)
Surgical ≥35	9.4 (9.2)	6.5 (6.2)	6.6 (6.4)	6.8 (6.6)	6.8 (6.5)	7.3 (7.1)

American Diabetes Association®

Connected for Life

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International Experts Outline Diabetes Remission Diagnosis Criteria

ARLINGTON, Va. (August 30, 2021) – People with type 2 diabetes should be considered in remission after sustaining normal blood glucose (sugar) levels for three months or more, according to a new consensus statement from the American Diabetes Association® (ADA), the Endocrine Society, the European Association for the Study of Diabetes and Diabetes UK jointly published in *Diabetes Care*, the *Journal of Clinical Endocrinology & Metabolism*, *Diabetologia*, and *Diabetic Medicine*, respectively.

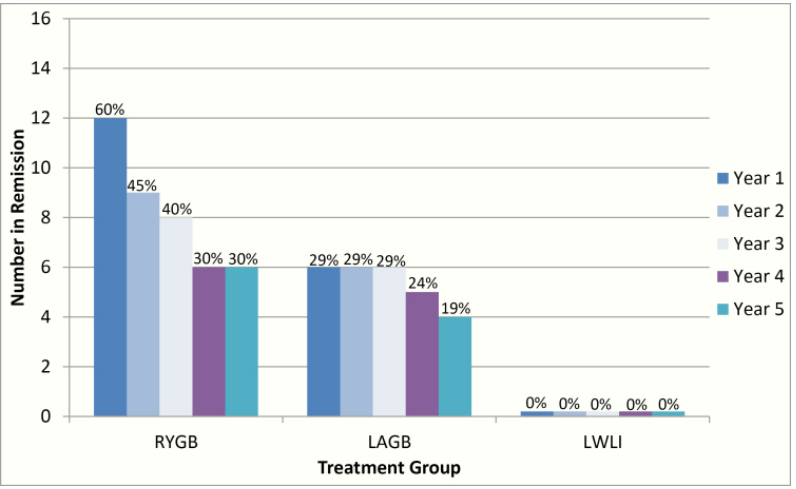
1. Remission should be defined as a return of HbA1c to less than 6.5% that occurs spontaneously or following an intervention and that persists for at least three months in the absence of usual glucose-lowering pharmacotherapy.
2. When HbA1c is determined to be an unreliable marker of long-term glycemic control, fasting plasma glucose of less than 126 mg/dL (<7.0 mmol/L) or estimated HbA1c less than 6.5% calculated from continuous glucose monitoring values can be used as alternate criteria.
3. Testing of HbA1c to document a remission should be performed just prior to an intervention and no sooner than three months after initiation of the intervention or withdrawal of any glucose-lowering pharmacotherapy.
4. Subsequent testing to determine long-term maintenance of a remission should be done at least yearly, together with the testing routinely recommended for potential complications of

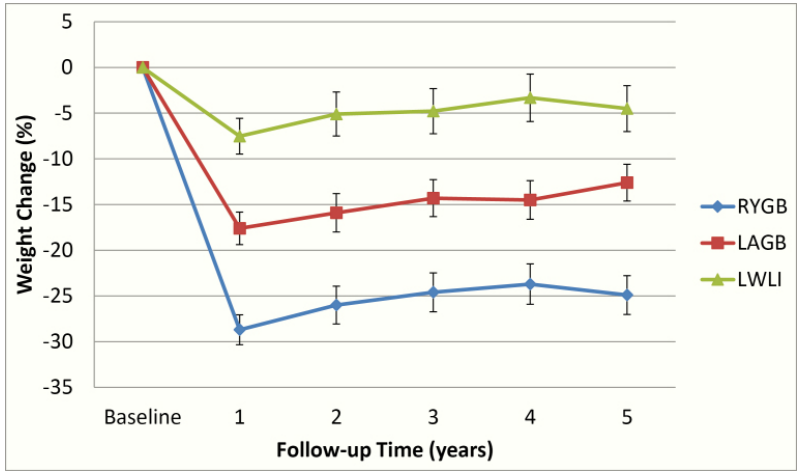
Bariatric Surgery vs Lifestyle Intervention for Diabetes Treatment: 5-Year Outcomes From a Randomized Trial

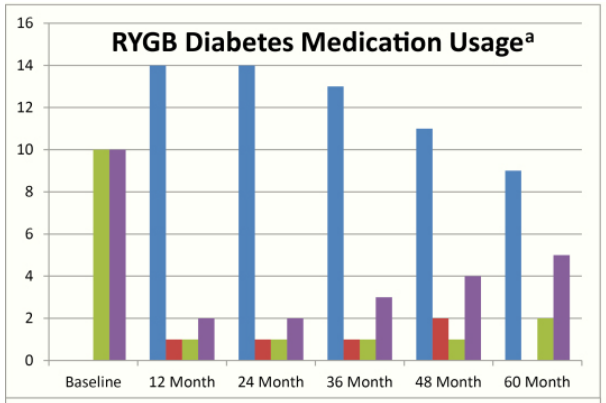
Anita P. Courcoulas,[1] James W. Gallagher,[1] Rebecca H. Neiberg,[2] Emily B. Eagleton,[1] James P. DeLany,[3] Wei Lang,[4] Suriya Punchai,[1,5] William Gourash,[6] and John M. Jakicic[7]

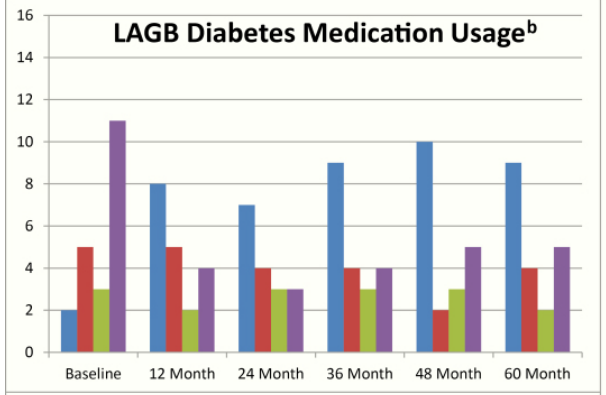
J Clin Endocrinol Metab, March 2020, 105(3):866–876

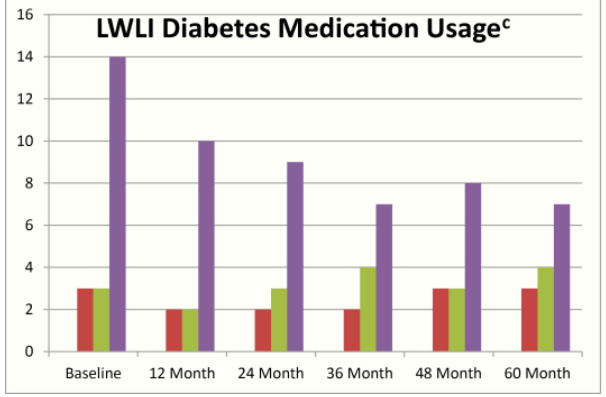
21 life style. 20 RYGB. 20 LAGB











None
Insulin Only
Insulin & Other Medication
Oral & Other Medication

[a] Baseline n=20;
12 Month n=18;
24 Month n=18;
36 Month n=18;
48 Month n=18;
60 Month n=16

[b] Baseline n=21;
12 Month n=19;
24 Month n=17;
36 Month n=20;
48 Month n=20;
60 Month n=20

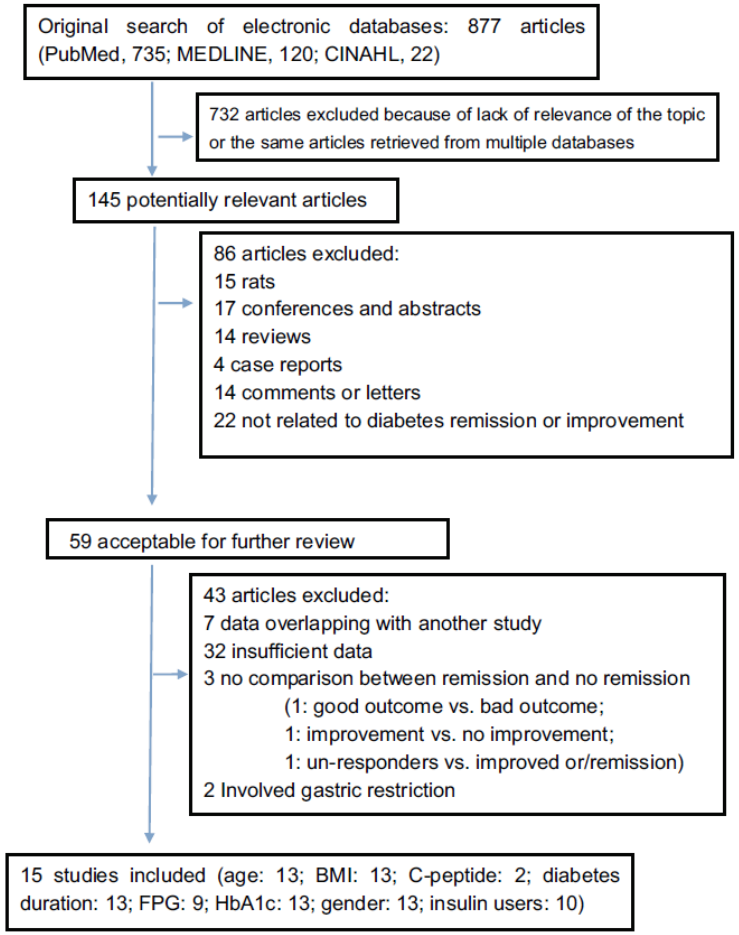
[c] Baseline n=20;
12 Month n=14;
24 Month n=14;
36 Month n=13;
48 Month n=14;
60 Month n=14

OBES SURG (2015) 25:199–208
DOI 10.1007/s11695-014-1391-y

ORIGINAL CONTRIBUTIONS

Predictive Factors of Type 2 Diabetes Mellitus Remission Following Bariatric Surgery: a Meta-analysis

Guo-Feng Wang · Yong-Xin Yan · Ning Xu · Dong Yin · Yuan Hui · Ji-Ping Zhang · Guan-Jun Han · Ning Ma · Yan Wu · Jing-Zi Xu · Tao Yang



- **Edad**
- **IMC previo**
- **%peso perdido**
- **Duración de la diabetes**
- **Tratamiento con insulina**

Published in final edited form as:
Lancet Diabetes Endocrinol. 2014 January ; 2(1): 38–45. doi:10.1016/S2213-8587(13)70070-6.

A probability score for preoperative prediction of type 2 diabetes remission following RYGB surgery

Christopher D. Still, DO[1,2], G. Craig Wood, MS[1], Peter Benotti, MD[1], Anthony T. Petrick, MD[3], Jon Gabrielsen, MD[3], William E. Strodel, MD[3], Anna Ibele, MD[3], Jamie Seiler, PA[1,2], Brian A. Irving, PhD[1,2], Melisa P. Celaya, MS[4,5], Robin Blackstone, MD[4,6], Glenn S. Gerhard, MD[1,7], and George Argyropoulos, PhD[1,8,*]

DiaRem score

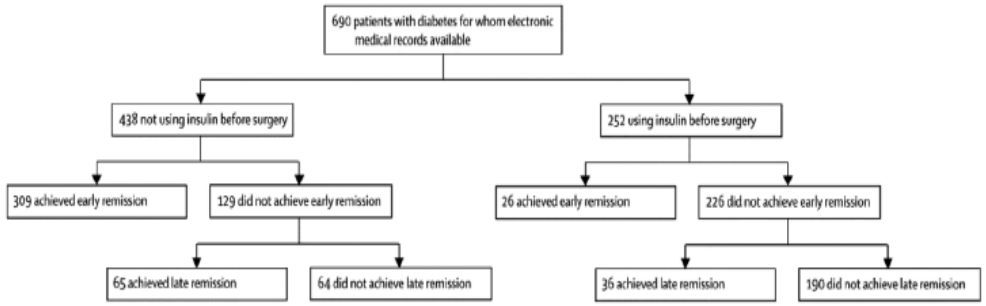
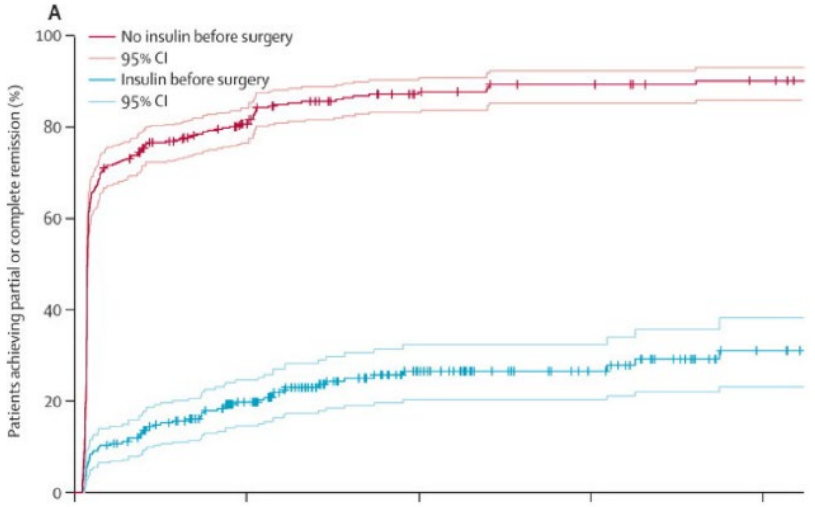


Figure 1. Flow chart describing the patient selection strategy for the Primary cohort
The indicated sample sizes (N) were used for the corresponding type of analysis, before and after stratification by insulin use [i.e., overall remission (partial + complete), predictors of early or late (partial + complete) remission].



Failure of T2D remission				
		Hazard ratio	95% Confidence interval	P-value
Pre-operative Insulin medication	Yes	5·90	[4·41, 7·90]	<0·0001
	No	Reference	-	-
Age (years)	<40	Reference	-	
	40–50	1·08	[0·82, 1·41]	0·602
	50–60	1·31	[1·00, 1·73]	0·053
	60+	1·78	[1·27, 2·49]	0·0009
Pre-operative HbA1c (%)	<6·5	Reference	-	-
	6·5–6·9	1·46	[1·12, 1·89]	0·0045
	7·0–8·9	2·51	[1·96, 3·23]	<0·0001
	9·0+	3·35	[2·24, 5·03]	<0·0001
Pre-operative diabetes medications	Other*	Reference	-	-
	ISA+Sulf†	2·07	[1·50, 2·84]	<0·0001

DiaRem score

Variable	Score
Age (yr)	
<40	0
40–49	1
50–59	2
≥60	3
HbA1c (%)	
<6.5	0
6.5–6.9	2
7.0–8.9	4
≥9.0	6
Other diabetes drugs	
No sulfonylureas or insulin-sensitizing agents other than metformin	0
Sulfonylureas and insulin-sensitizing agents other than metformin	3
Treatment with insulin	
No	0
Yes	10
Overall score (sum of the four components)	0–22
Probability of remission in each DiaRem score subgroup*	
0–2	87 (83–90)
3–7	66 (61–70)
8–12	32 (24–40)
13–17	16 (12–21)
18–22	5 (0–9)

DiaRem score: external validation

www.thelancet.com/diabetes-endocrinology **Vol 2 January 2014**

	Still and colleagues' primary cohort (N=690)[1] ≤2 years after surgery*			Cleveland Clinic cohort (N=136) >5 years after surgery[3]		
	n (%)	Partial or complete remission (% [95% CI])	Complete remission (% [95% CI])	n (%)	Partial or complete remission (%)	Complete remission (%)
0–2	188 (27%)	88% (83–92)	61% (54–68)	29 (21%)	86%	55%
3–7	211 (30%)	64% (58–71)	32% (25–38)	50 (37%)	78%	32%
8–12	70 (10%)	23% (13–33)	10% (3–17)	20 (15%)	30%	20%
13–17	167 (24%)	11% (6–16)	5% (2–9)	22 (16%)	27%	5%
18–22	54 (8%)	2% (0–5)	0%	15 (11%)	20%	7%

*In most patients.

Table: **Prediction of diabetes remission according to DiaRem score in Still and colleagues' study compared with the Cleveland Clinic cohort**

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Ann Surg. 2013 October ; 258(4): 628–637. doi:10.1097/SLA.0b013e3182a5034b.

Can Diabetes Be Surgically Cured?:

Long-Term Metabolic Effects of Bariatric Surgery in Obese Patients with Type 2 Diabetes Mellitus

Stacy A. Brethauer, MD[*], **Ali Aminian, MD**[*], **Héctor Romero-Talamás, MD**[*], **Esam Batayyah, MD**[*], **Jennifer Mackey, RN**[*], **Laurence Kennedy, MD**[†], **Sangeeta R. Kashyap, MD**[†], **John P. Kirwan, PhD**[†], **Tomasz Rogula, MD**[*], **Matthew Kroh, MD**[*], **Bipan Chand, MD**[‡], and **Philip R. Schauer, MD**[*]

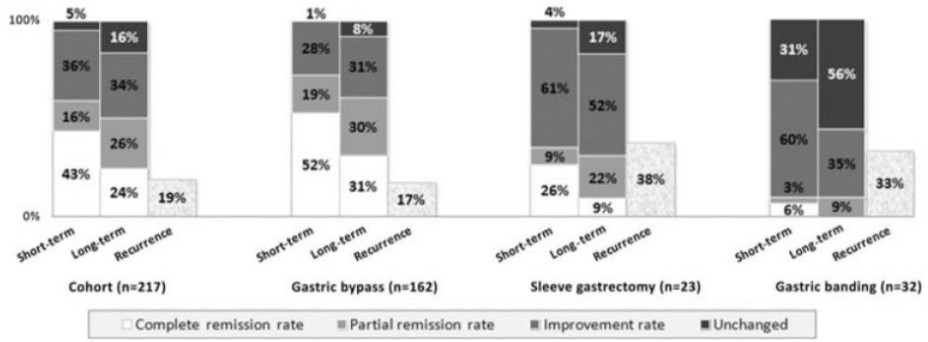


Figure 2.
Short- and long-term diabetes remission and recurrence rates according to procedure type.

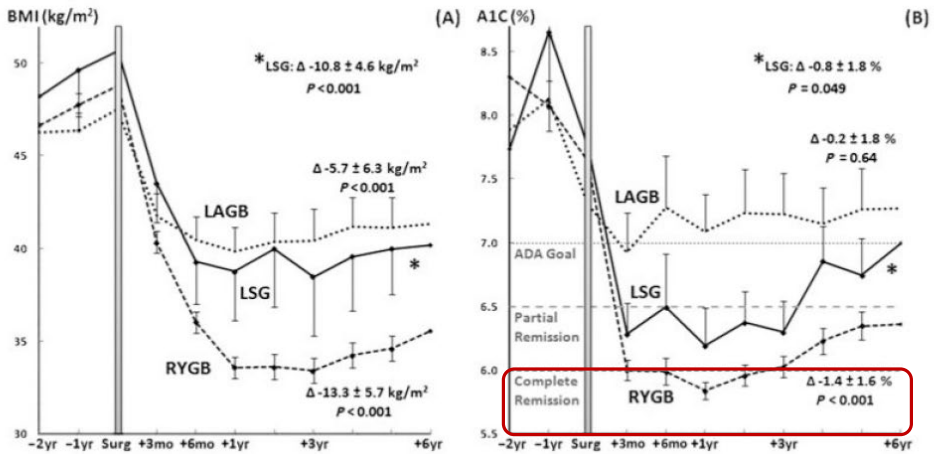


Figure 1.
Changes in BMI (A) and A1C (B) according to procedure type. Δ: Mean ± SD at the last follow-up point—baseline at time of surgery.

Table 1
Definitions of Glycemic Outcomes after Bariatric Surgery[*]

Outcome	Definition
Complete remission	Normal measures of glucose metabolism (A1C <6%, FBG <100 mg/dL) for 1 yr in the absence of antidiabetic medications.
Partial remission	Sub-diabetic hyperglycemia (A1C 6%–6.4%, FBG 100–125 mg/dL) for 1 yr in the absence of anti-diabetic medications.
Improvement	Significant reduction in A1C (by >1%) or FBG (by >25 mg/dL) OR reduction in A1C and FBG accompanied by a decrease in antidiabetic medication requirement (by discontinuing insulin or 1 oral agent, or 1/2 reduction in dose) for at least 1-yr duration.
Unchanged	The absence of remission or improvement as described earlier.
Recurrence	FBG or A1C in the diabetic range (≥126 mg/dL and ≥6.5%, respectively) OR need for antidiabetic medication after initial complete or partial remission.

[*] Criteria adapted from references 7 and 15.

DiaRem scores were calculated for all eligible patients. The scoring system is described in detail elsewhere [5]. Briefly, the DiaRem is a weighted score based on the sum of an age score (<40 = 0, 40–49 = 1, 50–59 = 2, 60+ = 3), insulin dependence (no = 0, yes = 10), diabetes medication use (additional 3 points if on sulfonylureas and insulin sensitizing agent other than metformin), and HbA1c (<6.5% = 0, 6.5–6.9% = 2, 7.0–8.9% = 4, 9.0%+ = 6), ranging from 0 to 22 points. Patients were stratified into groups by DiaRem score (0–2, 3–7, 8–12, 13–17, and 18–22.)

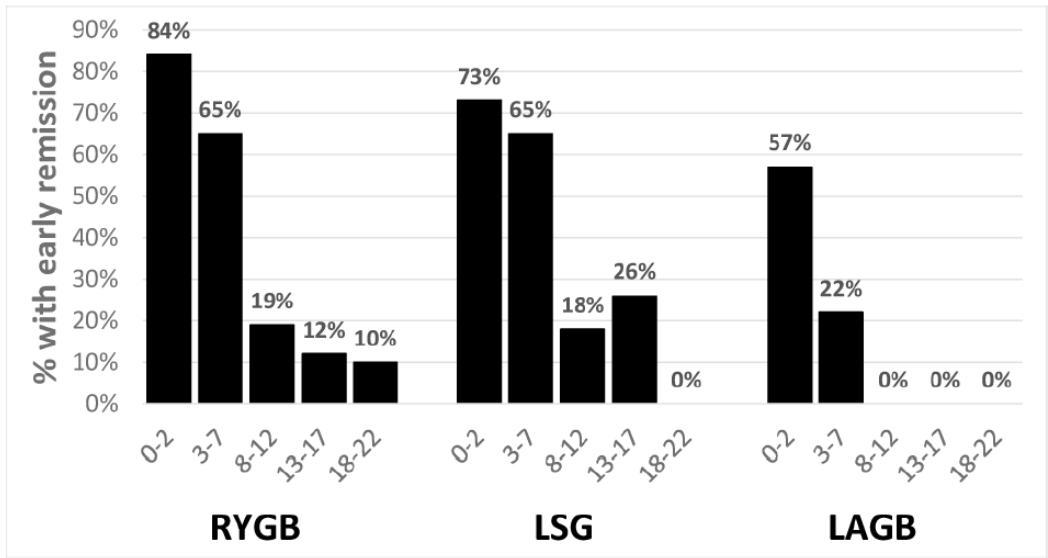


Figure 1.
Percent with early diabetes remission by surgery type (Wilcoxon p<0.001 for each surgery type)

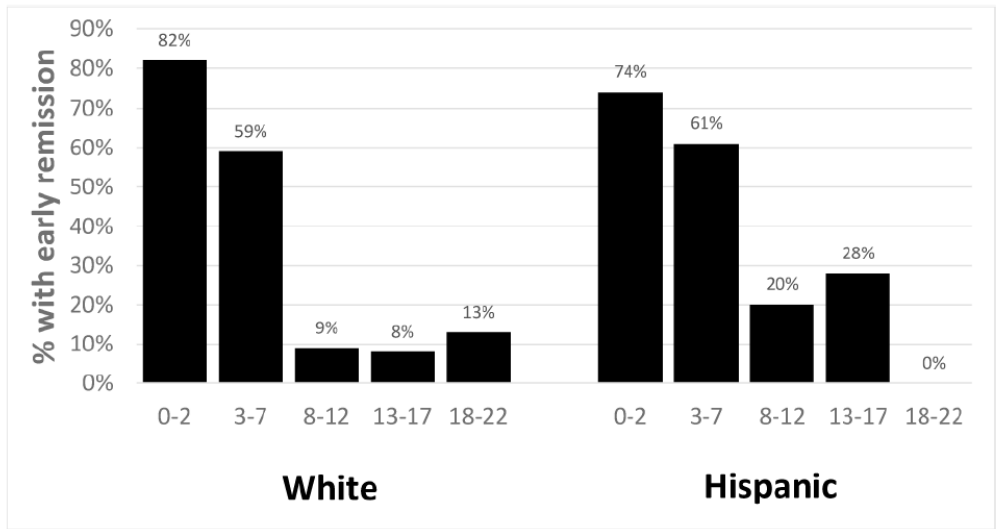


Figure 2.
Percent with early diabetes remission by ethnicity (Wilcoxon p<0.001 for each surgery type)

scientific reports

OPEN

Factors associated with resolution of type-2 diabetes mellitus after sleeve gastrectomy in obese adults

Ahmed Abdallah Salman[1✉], Mohamed Abdalla Salman[2], Mohamed A. Marie[1], Ahmed Rabiee[1], Mona Youssry Helmy[1], Mohamed Sabry Tourky[3], Mohamed Gamal Qassem[4], Hossam El-Din Shaaban[5] & Mohamed D. Sarhan[2]

Scientific Reports | (2021) 11:6002 | https://doi.org/10.1038/s41598-021-85450-9

	B	*p* value	OR (95% CI)
Age ≤ 45 vs. > 45	1.929	0.001	6.9 (2.1–22.2)
Duration of DM ≤ 5 vs. > 5 years	2.808	< 0.001	16.6 (4.8–57.9)
Oral hypoglycemics Single vs. Multiple	2.079	0.006	8.0 (1.8–35.4)
C-peptide > 2.72 vs. ≤ 2.72 ng/mL	5.643	< 0.001	282.2 (23.6–3377.5)
HOMA-IR ≤ 4.6 vs. > 4.6	3.579	< 0.001	35.8 (9.6–134.0)

		CR n = 86	No CR n = 140	*p* value
Age (years)		36.4 ± 6.7	44.8 ± 8.4	< 0.001
Sex (male/female)	Male	50 (39.1%)	78 (60.9%)	0.721
	Female	36 (36.7%)	62 (63.3%)	
Duration of diabetes mellitus		4 (1–8)	7 (1–15)	< 0.001
Hypertension	Yes	46 (40.4%)	68 (59.6%)	0.473
	No	40 (35.7%)	72 (64.3%)	
Dyslipidemia	Yes	38 (38.8%)	60 (61.2%)	0.845
	No	48 (37.5%)	80 (62.5%)	
Treatment of diabetes mellitus				
Insulin therapy	Yes	26 (30.2%)	60 (69.8%)	0.058
	No	60 (42.9%)	80 (57.1%)	
No. of oral hypoglycemics	Single	36 (69.2%)	16 (30.8%)	< 0.001
	Multiple	50 (28.7%)	124 (71.3%)	
Preoperative findings				
Weight (kg)		130.8 ± 13.3	127.4 ± 13	0.058
BMI (kg/m^2)		42.2 ± 4.5	43.6 ± 4.7	0.025
C-peptide (ng/mL)		5.3 ± 1.5	2.9 ± 1.1	< 0.001
Fasting blood glucose (mg/dL)		135.5 ± 40.6	195.4 ± 64.4	< 0.001
Glycated hemoglobin (%)		7.1 ± 1.0	8.1 ± 1.2	< 0.001
HOMA-IR		3.39 ± 1.23	6.18 ± 2.21	< 0.001
Postoperative findings				
Weight (kg)		97.2 ± 8.5	106.0 ± 10.2	< 0.001
BMI (kg/m^2)		27.4 ± 4.3	31.3 ± 5.0	< 0.001
% Weight loss		25.5 ± 4.0	16.7 ± 3.8	< 0.001
% BMI loss		35.3 ± 4.4	28.5 ± 4.9	< 0.001
Fasting blood glucose (mg/dL)		84.4 ± 7.2	161.9 ± 46.5	< 0.001
Glycated hemoglobin (%)		5.3 ± 0.4	7.2 ± 1.2	< 0.001
HOMA-IR		2.2 ± .9	4.3 ± 1.5	< 0.001

CR: complete remission. NoCR non-complete remission

Minimum Threshold of Bariatric Surgical Weight Loss for Initial Diabetes Remission

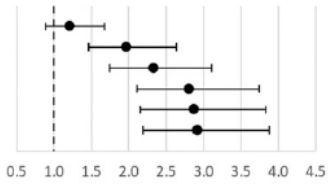
Diabetes Care 2022;45:92–99 | https://doi.org/10.2337/dc21-0714

Douglas Barthold,[1] Elizabeth Brouwer,[1] Lee J. Barton,[2] David E. Arterburn,[3] Anirban Basu,[1,4] Anita Courcoulas,[5] Cecelia L. Crawford,[6] Peter N. Fedorka,[7] Heidi Fischer,[3] Benjamin B. Kim,[8] Edward C. Mun,[8] Sameer B. Murali,[9] Kristi Reynolds,[2] Tae K. Yoon,[2] Robert E. Zane,[8] and Karen J. Coleman[2]

>5% TWL

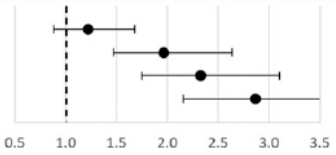
A

Weight loss	N	HR	p	CI
0-5%	115	Reference		
5-10%	356	1.22	0.23	(0.88 - 1.68)
10-15%	684	1.97	0.00	(1.47 - 2.64)
15-20%	1157	2.33	0.00	(1.74 - 3.11)
20-25%	1366	2.81	0.00	(2.11 - 3.75)
25-30%	1136	2.88	0.00	(2.16 - 3.83)
>30%	1114	2.92	0.00	(2.19 - 3.88)

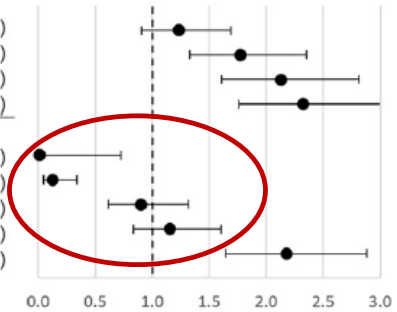


B

Weight loss	N	HR	p	CI
0-5%	115	Reference		
5-10%	356	1.22	0.23	(0.88 - 1.68)
10-15%	684	1.97	0.00	(1.47 - 2.64)
15-20%	1157	2.33	0.00	(1.74 - 3.11)
> 20%	3616	2.87	0.00	(2.16 - 3.81)



Weight loss	N	HR	p	CI
		No insulin use		
0-5%	73	Reference		
5-10%	236	1.23	0.19	(0.90 - 1.69)
10-15%	489	1.77	0.00	(1.33 - 2.36)
15-20%	822	2.13	0.00	(1.61 - 2.82)
> 20%	2326	2.32	0.00	(1.76 - 3.06)
		Insulin use		
0-5%	42	0.01	0.03	(0.00 - 0.73)
5-10%	120	0.12	0.00	(0.05 - 0.33)
10-15%	195	0.90	0.58	(0.61 - 1.32)
15-20%	335	1.16	0.38	(0.84 - 1.60)
> 20%	1290	2.18	0.00	(1.64 - 2.88)



Weight loss	N	HR	p	CI
		White		
0-5%	35	Reference		
5-10%	118	1.28	0.44	(0.69 - 2.37)
10-15%	225	1.96	0.02	(1.11 - 3.45)
15-20%	399	2.42	0.00	(1.39 - 4.20)
> 20%	1282	3.16	0.00	(1.83 - 5.45)
		Black		
0-5%	27	1.37	0.40	(0.66 - 2.84)
5-10%	90	1.96	0.02	(1.10 - 3.51)
10-15%	152	2.67	0.00	(1.52 - 4.67)
15-20%	227	2.78	0.00	(1.59 - 4.85)
> 20%	558	3.17	0.00	(0.00 - 5.47)
		Hispanic		
0-5%	47	1.07	0.84	(0.53 - 2.19)
5-10%	130	0.86	0.65	(0.45 - 1.65)
10-15%	281	2.13	0.01	(1.22 - 3.73)
15-20%	475	2.69	0.00	(1.55 - 4.67)
> 20%	1639	3.28	0.00	(1.90 - 5.65)
		Other		
0-5%	6	0.84	0.85	(0.14 - 4.93)
5-10%	18	0.82	0.78	(0.21 - 3.19)
10-15%	26	1.85	0.10	(0.89 - 3.82)
15-20%	56	2.69	0.00	(1.47 - 4.93)
> 20%	137	3.40	0.00	(1.94 - 5.97)

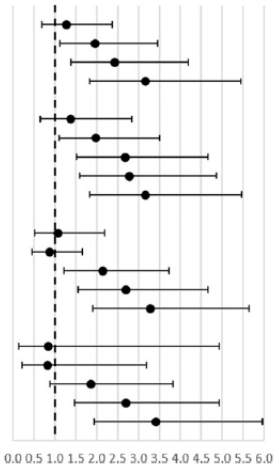


Table 1—Descriptive statistics for all patients with T2DM (*N* = 5,928) and the covariates included in all statistical models

	All	0–5% TWL	>5–10% TWL	>10–15% TWL	>15–20% TWL	>20% TWL
n	5,928	115	356	684	1,157	3,616
T2DM remission (yes), *n* (%)	4,216 (71)	29 (25)	125 (35)	400 (58)	815 (70)	2,847 (79)
Years to T2DM remission	1.0 (0.92)	1.5 (1.24)	1.1 (1.13)	1.0 (0.99)	0.8 (0.68)	1.0 (0.95)
Age (years)	49.8 (10.3)	51.4 (10.8)	50.3 (10.9)	50.8 (10.2)	50.4 (10.2)	49.3 (10.3)
Age ≥65 years, *n* (%)	397 (7)	11 (10)	34 (10)	59 (9)	88 (8)	205 (6)
RYGB, *n* (%)	3,382 (57)	41 (36)	114 (32)	251 (37)	579 (50)	2,397 (66)
Hispanic, *n* (%)	2,572 (43)	47 (41)	130 (37)	281 (41)	475 (41)	1,639 (45)
Non-Hispanic White, *n* (%)	2,059 (35)	35 (30)	118 (33)	225 (33)	399 (34)	1,282 (35)
Non-Hispanic Black, *n* (%)	1,054 (18)	27 (23)	90 (25)	152 (22)	227 (20)	558 (15)
Other races or unknown, *n* (%)	243 (4)	6 (5)	18 (5)	26 (4)	56 (5)	137 (4)
	43.8 (6.9)	42.5 (6.4)	42.5 (6.6)	42.9 (6.8)	43.4 (6.9)	44.2 (6.95)
	1,016 (17)	18 (16)	47 (13)	95 (14)	173 (15)	683 (19)
	1,982 (33)	42 (37)	120 (34)	195 (29)	335 (29)	1,290 (36)
	8.4 (5.4)	8.9 (5.7)	8.5 (5.4)	8.0 (5.1)	7.9 (5.2)	8.6 (5.5)
	2,208 (37)	45 (39)	132 (37)	227 (33)	369 (32)	1,435 (40)
	4,326 (73)	82 (71)	263 (74)	493 (72)	872 (75)	2,616 (72)
	7.5 (1.1)	7.6 (1.2)	7.5 (1.1)	7.5 (1.1)	7.4 (1.0)	7.5 (1.1)
	269.6 (54.4)	262.6 (52.0)	261.4 (49.8)	265.1 (52.9)	265.7 (52.9)	272.7 (54.8)
	3,793 (64)	82 (71)	234 (66)	434 (63)	758 (66)	2,285 (63)
	71 (1)	0 (0)	4 (1)	13 (2)	12 (1)	42 (1)
	922 (16)	20 (17)	42 (12)	114 (17)	175 (15)	571 (16)
	1,138 (19)	22 (19)	70 (20)	127 (19)	206 (18)	713 (20)
	318 (5)	7 (6)	17 (5)	28 (4)	60 (5)	206 (6)
	387 (7)	9 (8)	21 (6)	42 (6)	75 (6)	240 (7)
	2,529 (43)	50 (43)	149 (42)	295 (43)	504 (44)	1,531 (42)
	2,582 (44)	53 (46)	170 (48)	302 (44)	506 (44)	1,551 (43)
	1,737 (29)	36 (31)	128 (36)	203 (30)	339 (29)	1,031 (29)
NSAID use 12 months before, *n* (%)	2,546 (43)	44 (38)	137 (38)	292 (43)	490 (42)	1,583 (44)
NSAID use 3 months before, *n* (%)	920 (16)	17 (15)	62 (17)	110 (16)	186 (16)	545 (15)
Dyslipidemia medication use, *n* (%)	3,337 (56)	73 (63)	190 (53)	397 (58)	654 (57)	2,023 (56)
Number of T2DM medication	1.3 (0.98)	1.4 (0.98)	1.3 (0.96)	1.2 (0.93)	1.3 (0.93)	1.3 (1.0)
Elixhauser score	3.8 (10.6)	5.0 (10.1)	3.8 (9.9)	3.4 (9.96)	3.3 (10.0)	4.0 (10.96)
Hospital days 12 months before	0.1 (0.4)	0.1 (0.3)	0.1 (0.4)	0.1 (0.35)	0.1 (0.3)	0.1 (0.4)
Emergency visits 12 months before	0.4 (0.9)	0.3 (0.6)	0.3 (0.8)	0.3 (0.8)	0.3 (0.8)	0.4 (0.97)
% attendance outpatient visits 12 months before	75.7 (12.1)	76.4 (11.9)	74.4 (12.1)	75.2 (12.2)	76.5 (11.8)	75.6 (12.2)
Weight loss (lb) 12 months before	−16.4 (13.62)	−21.5 (15.21)	−19.8 (15.65)	−17.1 (12.99)	−16.8 (13.70)	−15.6 (13.36)

Data are presented as *n* (%) for categorical variables and mean (SD) for continuous variables. All variables except T2DM remission and %TWL were measured at the time of surgery.

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Review

Prediction of Type 2 Diabetes Remission after Bariatric or Metabolic Surgery

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OTRAS VARIABLES?

Table 2. Calculation of DiaRem score and probability of diabetes remission after Roux-en-Y gastric bypass

Variable	Score
Age (yr)	
<40	0
40–49	1
50–59	2
≥60	3
HbA1c (%)	
<6.5	0
6.5–6.9	2
7.0–8.9	4
≥9.0	6
Other diabetes drugs	
No sulfonylureas or insulin-sensitizing agents other than metformin	0
Sulfonylureas and insulin-sensitizing agents other than metformin	3
Treatment with insulin	
No	0
Yes	10
Overall score (sum of the four components)	0–22
Probability of remission in each DiaRem score subgroup*	
0–2	87 (83–90)
3–7	66 (61–70)
8–12	32 (24–40)
13–17	16 (12–21)
18–22	5 (0–9)

Values are presented as probability (%) with 95% confidence interval.
*Including both partial and complete remissions.
HbA1c, glycosylated hemoglobin.
Adapted from Still CD, et al. Lancet Diabetes Endocrinol 2014;2:38-45, with permission from Elsevier.[31]

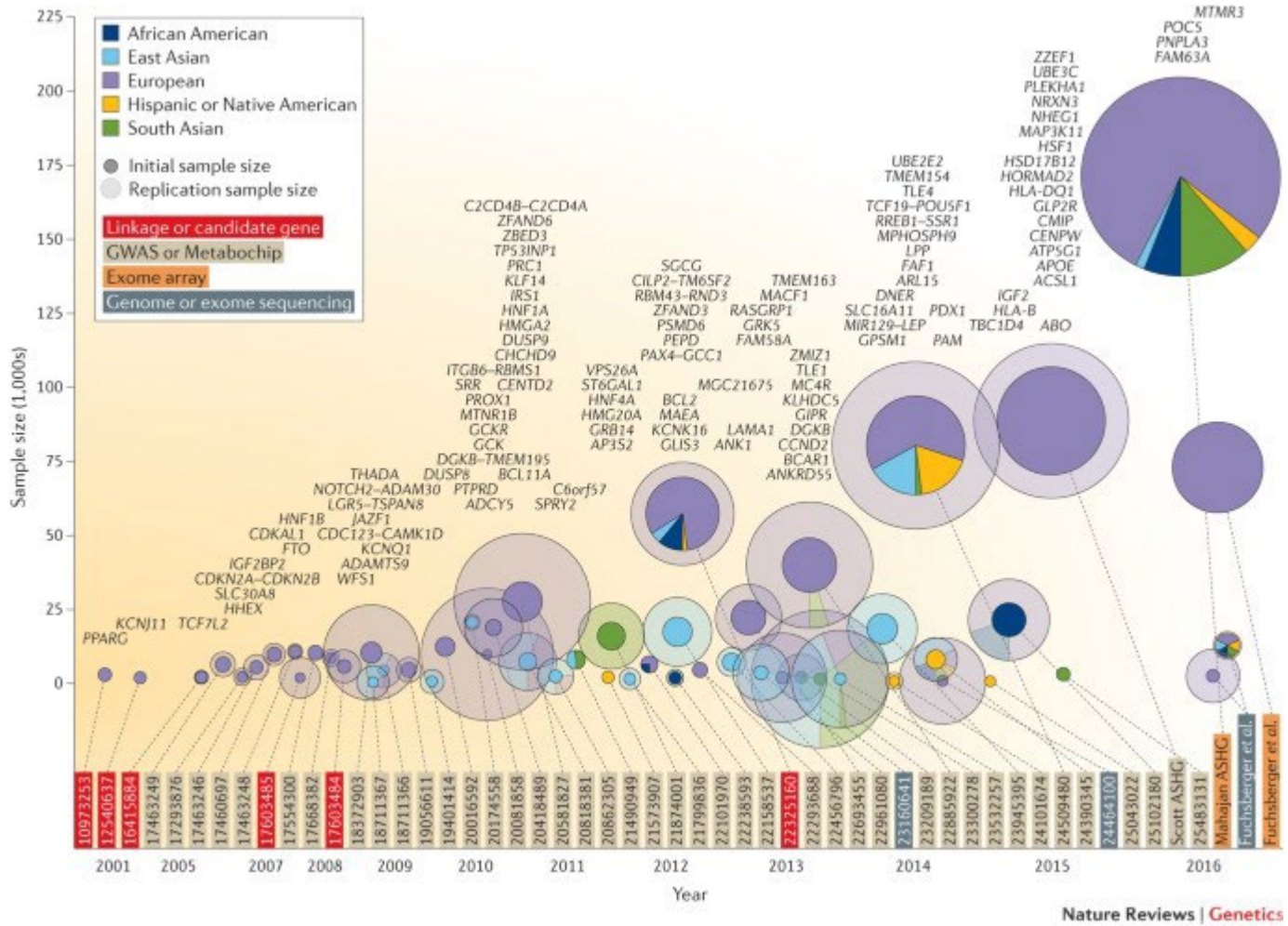
Table 3. Modified ABCD scoring system and the probability of diabetes remission after gastric bypass

Variable	Point on ABCD index			
	0	1	2	3
Age (yr)	≥40	<40		
BMI (kg/m²)	<27.0	27.0–34.9	35.0–41.9	≥42.0
C-peptide (mg/L)	<2.0	2.0–2.9	3.0–4.9	≥5.0
Duration of diabetes (yr)	>8	4–8	1–3.9	<1

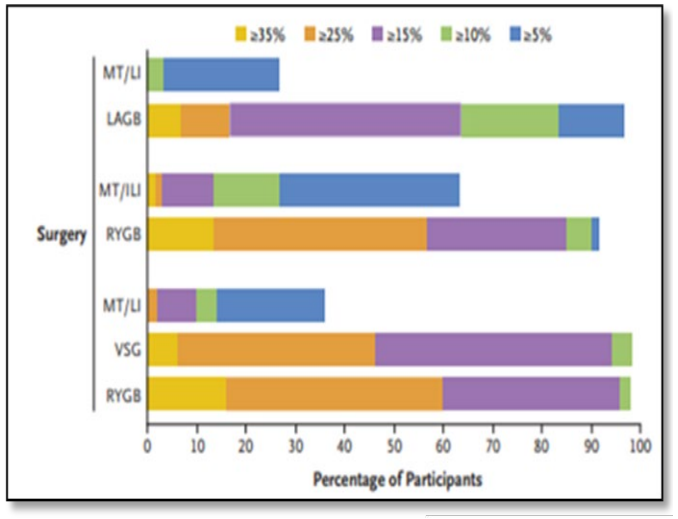
ABCD score (%)	Probability of diabetes remission*	
	Complete remission	Partial remission
0	5.9	5.9
1	5.0	20.0
2	26.3	38.6
3	31.9	42.0
4	52.5	67.8
5	55.4	75.0
6	61.7	78.3
7	77.0	92.3
8	85.2	96.3
9	87.1	87.1
10	93.9	93.3
Overall	52.2	64.7

*According to the analysis of 510 patients of Asian Diabetes Surgery Study.
BMI, body mass index.
Adapted from Lee WJ, et al. Obes Surg 2015;25:1772-8, with permission from Springer Nature.[35]

Carga genetica

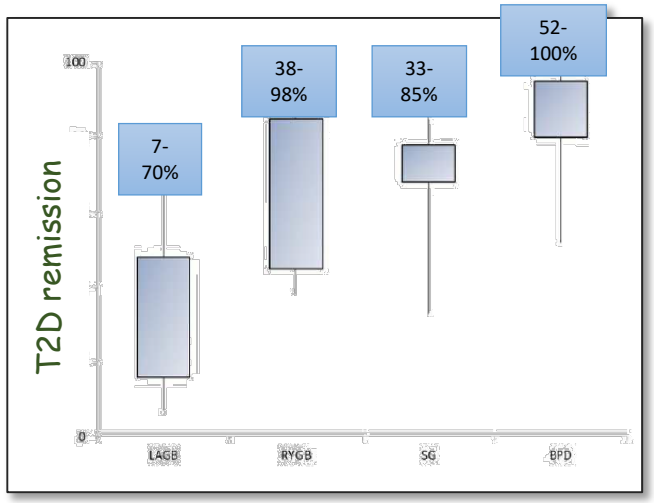


Around **20–25%** of patients that undergo BS **do not achieve successful weight loss** and about **30–35% regain** significant weight.



The possibility of elucidating a **combination of SNPs** responsible for the variability in the predisposition to obesity, the evolution of comorbidities offers the opportunity to design **individualized therapy strategies**.

About **20–35% relapse of T2D** after 5 years of BS.



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Chikunguwo SM et al. Surg Obes Relat Ds 2010
Schauer PR. Ann Surg 2003
Heymsfield S et al. NEJM. 2017

GPS Appetite regulation

SNP	GENE	Minor Allele	Major allele	Risk allele	Protective allele	Risk homozygote	Risk heterozygote
rs2419621	ACSL5	T	C	n.a.	T	2	2
rs5082	APOA2	T	C	n.a.	C	2	0
rs651821	APOA5	C	T	n.a.	C	2	1
rs894160	PLIN1	A	G	n.a.	A	2	1
rs1137100	LEPR	G	A	n.a.	A	2	0
rs1800849	UCP3	T	C	n.a.	C	2	0
rs659366	UCP2	T	C	n.a.	T	2	1
rs1801282	PPARG	G	C	G	n.a.	-2	-2
rs682444	Chr.4	G	A	G	n.a.	2	1

GPS Weight loss in response to exercise

SNP	GENE	Minor Allele	Major allele	Risk allele	Protective allele	Risk homozygote	Risk heterozygote
			T	n.a.	A	2	0
	BDNF-AS	T	G	T	n.a.	2	1
rs12535708	LEP	A	C	C	n.a.	2	1
rs52820871	MC4R	G	T	n.a.	G	-2	-1
rs17700633	MC4R	A	G	A	n.a.	2	1
rs2229616	MC4R	A	G	n.a.	A	-2	-1

GPS Bariatric surgery (Still)

SNP	GENE	Minor allele	Major allele	Risk allele	Protective allele	Risk homozygote	Risk heterozygote
rs7566605	INSIG2	C	G	C	n.a.	2	1
rs9939609	FTO	A	T	A	n.a.	2	1

GPS Diabetes

SNP	GENE	Minor	Major	Risk allele	Protective allele	Risk homozygote	Risk heterozygote
rs4343	ACE	G	A	G	n.a.	2	1
rs16861209	ADIPOQ	A	C	A	n.a.	2	1
rs5186	AGTR1	C	A	C	n.a.	2	1
CD010	APOC3	A	G	A	n.a.	2	1
rs7754840	CDKAL1	C	G	C	n.a.	2	1
rs10811661	CDKN2B	C	T	C	n.a.	2	1
rs696217	GHRL	T	G	T	n.a.	2	1
rs1800795	IL6	C	G	n.a.	C	-2	-1
rs12970134	MC4R	A	G	A	n.a.	2	1
rs1800206	PPARA	G	C	G	n.a.	2	1

GPS Life style interventions (Moleres)

SNP	GENE	Minor e	Major e	Risk allele	Protective allele	Risk homozygote	Risk heterozygote
rs328	LPL	G	C	n.a.	G	2	1
rs696217	GHRL	T	G	n.a.	T	2	1
rs4994	ADRB3	C	T	n.a.	C	2	1
rs180079	IL6	C	G	n.a.	C	2	1

GPS Weight loss in response to diet

SNP	GENE	Minor	Major	Risk allele	Protective allele	Risk homozygote	Risk heterozygote
rs9939609	FTO	A	T	A	n.a.	2	1
rs17782313	MC4R	C	T	C	n.a.	2	1

Journal of *Clinical Medicine*

MDPI

Article

Genetic Testing to Predict Weight Loss and Diabetes Remission and Long-Term Sustainability after Bariatric Surgery: A Pilot Study

Andreea Ciudin [1,2,*,†], Enzamaria Fidilio [1,†], Angel Ortiz [1], Sara Pich [3], Eduardo Salas [3], Jordi Mesa [1,2], Cristina Hernández [1,2], Olga Simó-Servat [1,2], Albert Lecube [2,4] and Rafael Simó [1,2,*]

2019

Table 3. Baseline characteristics of the patients included in the study.

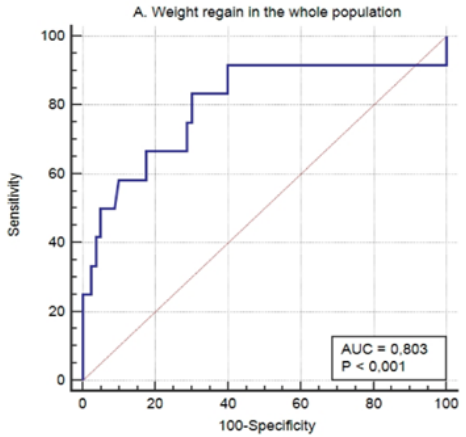
	TOTAL POPULATION
N	97
Age (years)	49.5 (42.0; 57.0)
Initial BMI (Kg/m2)	44.5 (41.4; 47.0)
2 y post-BS BMI (Kg/m2)	29.2 (26.0; 33.7)
5 y post-BS BMI (Kg/m2)	31.2 (26.7; 36.0)
Type 2 Diabetes (%)	48.5
Hypertension (%)	48.9
Dyslipidemia (%)	44.4
Sleep apnea (%)	28.4

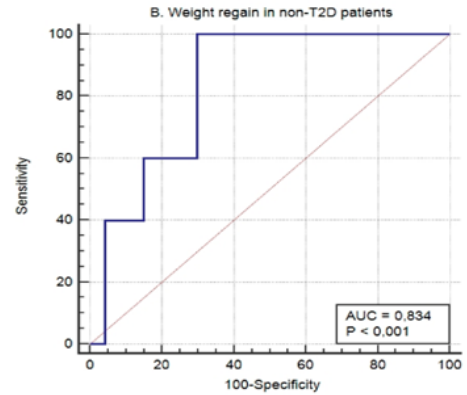
Continuous variables are expressed as median [1st quartile; 3rd quartile], and the categorial data as percentages. BMI: body mass index. BS: bariatric surgery. Type 2 Diabetes was defined according to diagnostic criteria by the ADA or use of medication. Hypertension was defined by increased systolic (≥140mmHg) or increased diastolic (≥90mmHg) blood pressure or by the use of antihypertensive drugs, according to current guidelines. Dyslipidemia was defined by the use of lipid-lowering drugs, decreased values of HDL cholesterol (men< 0,9mmol/L, women <1.0mmol/L) or by at least one increased value of total cholesterol (>5,2mmol/L), LDL cholesterol or triglycerides (>1.7mmol/L).

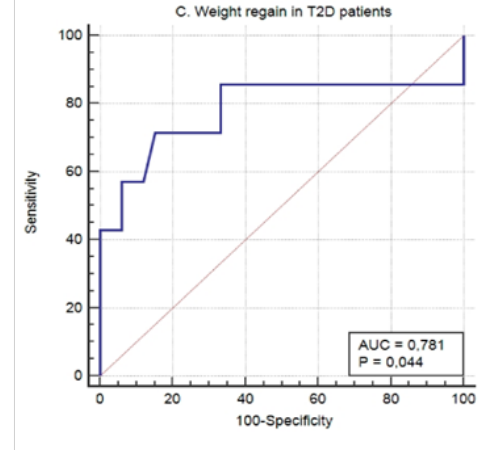
Table 4 . Characteristics of the patients included in the study according to presence of T2D.

	NON-DIABETIC PATIENTS	TYPE 2 DIABETIC PATIENTS	*p*-value
N	50	47	
Age (years)	48.0 (37.5; 55.0)	52.0 (46.0; 58.8)	0.0016
Initial BMI (Kg/m2)	45.2 (43.0; 48.5)	42.5 (40.1; 46.4)	0.008
2 y post-BS BMI (Kg/m2)	31.8 (26.1; 35.6)	30.9 (26.8; 35.7)	n.s.
5 y post-BS BMI (Kg/m2)	32.63 (21; 52.14)	33.68 (21; 46.43)	n.s.
Hypertension (%)	48.3	49.5	n.s.
Dyslipidemia (%)	43.2	45.7	n.s.
Sleep apnea (%)	27.2	29.7	n.s.

Continuous variables are expressed as median [1st quartile; 3rd quartile], and the categorial data as percentages. BMI: body mass index. BS: bariatric surgery. Hypertension was defined by increased systolic (≥140mmHg) or increased diastolic (≥90mmHg) blood pressure or by the use of antihypertensive drugs, according to current guidelines. Dyslipidemia was defined by the use of lipid-lowering drugs, decreased values of HDL cholesterol (men< 0,9mmol/L, women <1.0mmol/L) or by at least one increased value of total cholesterol (>5,2mmol/L), LDL cholesterol or triglycerides (>1.7mmol/L).







SNPs associated to response to BS did not improve the prediction scores for diabetes remission and relapse.

Diabetes Remission

Diabetes remission 73.91%

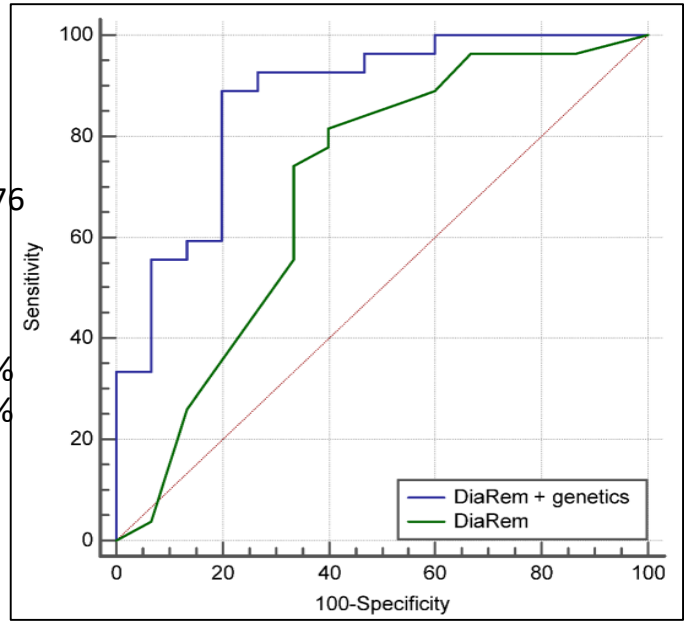
- 66.67% in the group of %EWL < 40%
- 77.42% in the group of %EWL > 75%

SNPs

- Obesity, hypocaloric diet, appetite regulation, and diabetes

AUROC 0.868
95%CI 0.709- 0.976
p < 0.0001

Sensitivity 76.47%
Specificity 83.33%



Diabetes Relapse

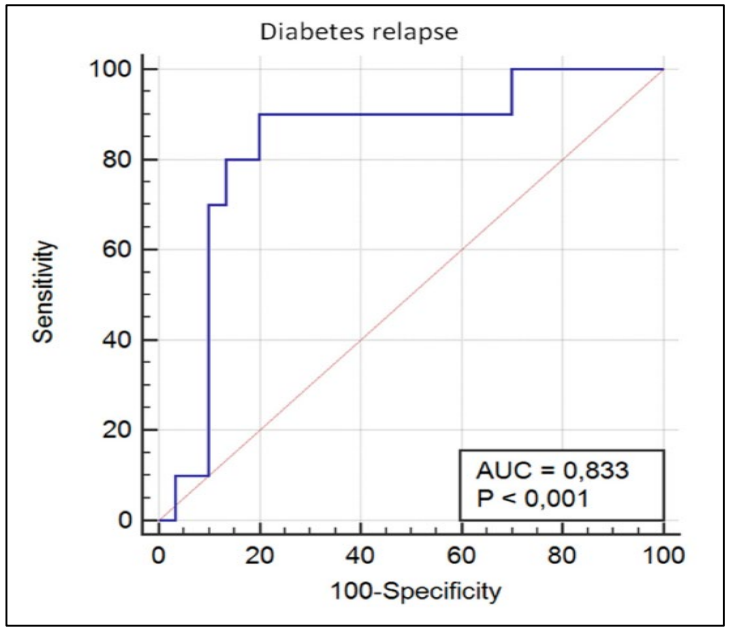
Diabetes relapse in 25% of the patients

SNPs

- Obesity, hypocaloric diet, appetite regulation, and diabetes

AUROC 0.833
95%CI 0.682-0.932
p < 0.0001

Sensitivity 90.00%
Specificity 80.00%



Journal of *Personalized Medicine*

MDPI

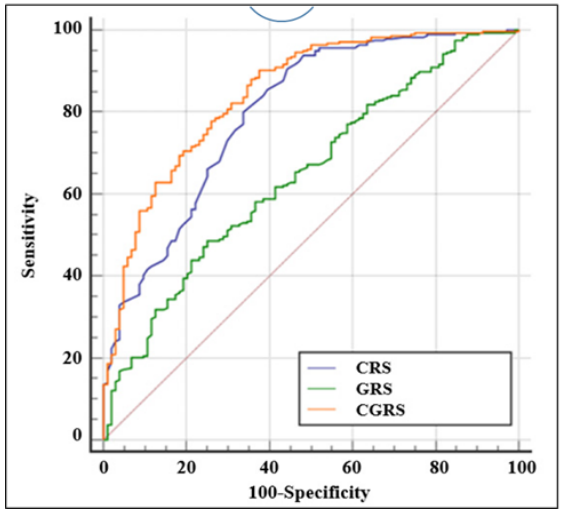
Article

A Clinical-Genetic Score for Predicting Weight Loss after Bariatric Surgery: The OBEGEN Study

Andreea Ciudin [1,2,3,†], Enzamaría Fidilio [1,2,†], Liliana Gutiérrez-Carrasquilla [4], Assumpta Caixàs [5,6], Núria Vilarrasa [3,7], Silvia Pellitero [8], Andreu Simó-Servat [7], Ramon Vilallonga [9], Amador Ruiz [9], Maricruz de la Fuente [10], Alexis Luna [11], Enric Sánchez [4], Mercedes Rigla [5,6], Cristina Hernández [1,2,3], Eduardo Salas [12], Rafael Simó [1,2,3,*] and Albert Lecube [3,4,*]

SNP	GENE	NAME	CHROMOSOME ALLOCATION OF HUMAN ORTHOLOGUE
rs11575892	AGRP	AGOUTI RELATED NEUROPEPTIDE	16q22.1
rs10490628	CCDC93	COILED-COIL DOMAIN CONTAINING 93	2q14.1
rs6454674	CNR1	CANNABINOID RECEPTOR 1	6q15
rs3778099	ESR1	ESTROGEN RECEPTOR 1	6q25.1
rs680	IGF2	INSULIN LIKE GROWTH FACTOR 2	11p15.5
rs3771942	INSIG2	INSULIN INDUCED GENE 2	2q14.1
rs1143643	IL-1B	INTERLEUKIN 1 BETA	2q14.1
rs2568958	NEGR1	NEURONAL GROWTH REGULATOR 1	1p31.1
rs7069102	SIRT1	SIRTUIN 1	10q21.3
rs2867125	TMEM18	TRANSMEMBRANE PROTEIN 18	2p25.3
rs45539933	UCP1	UNCOUPLING PROTEIN 1	4q31.2

Weight loss

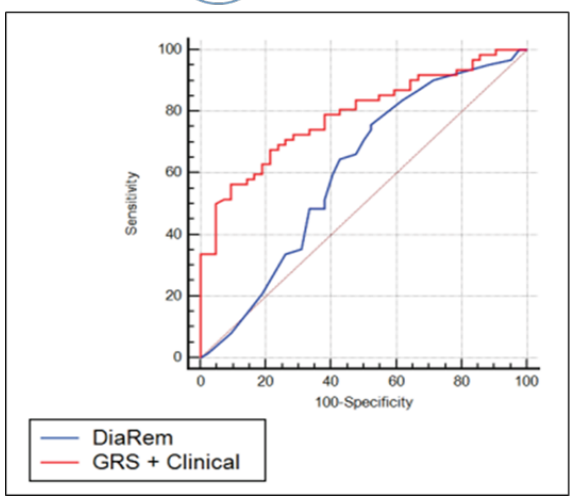


Clinical Risk Score
- **AUROC 0.775** (95% CI 0.731- 0.814); p < 0.0001
- Sensitivity 93.0% Specificity of 50.4%

Genetic Risk Score
- **AUROC 0.648** (95% CI 0.597 - 0.696); p < 0.0001
- Sensitivity 48.7% Specificity 75.0%

OBEGEN Clinical-Genetic Risk Score
- The OBEGEN-CGRS score ranges from −4 to +4 points
  - cut-off point to define a good responder of 0.662.
- **AUROC 0.845** (95% CI 0.805 to 0.880); p < 0.001
- Sensitivity 90.1% Specificity 65.5%.

Diabetes Remission



Clinical Risk Score
- **AUROC 0.703** (95% CI 0.621 - 0.784); p< 0.0001
- Sensitivity 44.9% Specificity 87.5%

Genetic Risk Score
- **AUROC 0.712** (95% CI 0.634 - 0.78); p< 0.0001
- Sensitivity 57.6% Specificity 75.0%

OBEGEN-DM Clinical Genetic Risk Score
- **AUROC 0.784** (95% CI 0.696 - 0.856); p< 0,0001
- Sensitivity 70.0% Specificity 75.5%

Pérdida seguimiento: solamente 36,5% de los pacientes intervenidos hace mas de 10 años tienen un seguimiento fiable.

Weight regain >10% from nadir

- Reganancia ponderal 60.6% a los 3 años y 68.7% a los 5 años, 80.7% a los 10 años
- Intervalo de reganacia ponderal 6-100%
- Media de edad pre-CB: 48.21±10.81 años, 73% mujeres, 85.4% Caucásicos

Recidiva de la diabetes tipo 2: 37,1% casos que remitieron en el primer año presentaron recidiva a partir del 3º año.

Datos relacionados con la reganancia ponderal a partir del 3º año tras la CB, en nuestra serie:

- **Perfil neuropsicológico basal.**
- **Carga genética.**
- **Adaptación metabólica tras la cirugía bariatrica.**
- ***¿Cambios en la composición corporal: perdida de masa muscular?***

REMISIÓN DE DIABETES TRAS LA CIRUGIA BARIATRICA

- **ABORDAJE PERSONALIZADO**
- **EXPECTATIVAS REALISTAS**
- **SUFICIENTE TIEMPO DE SEGUIMIENTO**