

Best weight loss model after standard bariatric surgery for morbidly obese patients in Korea

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Backgrounds

- ◆ National insurance coverage started for bariatric surgery in Korea.
- ◆ Laparoscopic sleeve gastrectomy and Roux-en Y gastric bypass are main standard bariatric procedures now..
- ◆ Two indicators for weight loss effect of surgery

EWL(Excess Weight Loss,%) Success : $\geq 50\%$

TWL(Total Weight Loss,%) Success : $\geq 25\%$

- ◆ It is argued that the definition of weight loss success is affected by pre-operative weight
- ◆ There have been a lot of weight loss prediction models, but no accurate predicting model for Korean obese patients due to lack of external validation

Aims

1. Evaluate feasibility and 1-year weight loss outcomes of these two operations (LSG & LRYGB) in Korean morbid obese patients
2. **SWL(Successful Weight Loss) criteria: EWL $\geq 50\%$ vs TWL $\geq 25\%$ -> To find out which of these two criteria is better by validating affecting factors predicting SWL using our data**
3. External validation of our data by 2 models
 - ① **Baltasar model used preoperative BMI** to predict BMI 1-year after operation :
[Predicted BMI=Initial BMI*0.4+11.75]
 - ① **Seysse model used preoperative weight** to predict weight loss after 1 year of surgery :
[Predicted TWL=0.4*preoperative weight-0.21*age]

Methods

- Total **137 patients**. From 2019 Jan to 2022 June
- Multi-center study(4 Hospitals)
 - Anam hospital of Korea Univ.
 - Guro hospital of Korea Univ.
 - Ansan hospital of Korea Univ.
 - Gandong hospital of Kyung Hee Univ.
- Sleeve gastrectomy (**N=76, 55.5%**) vs Roux-en Y gastric bypass (**N=61, 44.5%**)
- 1-Year follow up for Weight(kg) & Factors: Pre-Op Weight(Kg), BMI, ASA score, Diabetic mellitus, OP time, Hospital days, Complications -> regression analysis for affecting risk factors
- Validate 2 weight loss models predicting weight loss at 1-year after bariatric surgery using our data
 - Linear regression : relationship between predicted and observed BMI
 - Adjusted squared Pearson's correlation coefficient (R²) : diagnostic accuracy of each model

Results

Table 1. Demographic & postoperative findings after bariatric surgery of Korea obese patients

	Total (N=137) *	Sleeve gastrectomy (N=76) *	Roux-en-Y gastric bypass (N=61) *	P value
Age (years)	43.6±12.0	40.7 ± 12.0	47.3 ± 10.9	0.001
Sex				0.526
Male	42 (30.7%)	25 (32.9%)	17 (27.9%)	
Female	95 (69.3%)	51 (67.1%)	44 (72.1%)	
Preoperative weight (kg)	104.6 ± 23.0	109.4 ± 24.9	98.6 ± 17.7	0.004
Preoperative BMI (kg/m ²)	38.3 ± 6.4	39.8 ± 6.9	36.4 ± 5.1	0.001
DM	102 (74.5%)	46 (60.5%)	56 (91.8%)	<0.001
DM medication at operation	77 (56.2%)	36 (47.4%)	41 (67.2%)	0.02
ASA score				0.811
2	111 (81.0%)	60 (78.9%)	51 (83.6%)	
3	25 (18.2%)	15 (19.7%)	10 (16.4%)	
4	1 (0.7%)	1 (1.3%)	0	
Hospitalization (days)	5.0 ± 2.7	5.8 ± 3.3	4.0 ± 1.1	<0.001
Operation time (min)	137.2 ± 43.4	141.2 ± 46.0	132.2 ± 39.8	0.221
Postoperative complication	2 (1.5%)	2 (2.6%)	0	0.502

*Values are mentioned as mean ± standard deviation or number (%).

BMI: Body mass index; ASA: American Society of Anesthesiologists; DM: Diabetes mellitus, type 2

1 AKI
1 Omental bleeding

Results

Table 2. 1-year weight loss outcomes after bariatric surgery of Korean obese patients

	Total (N=137) *	Sleeve gastrectomy (N=76) *	Roux-en-Y gastric bypass (N=61) *	P value
Preoperative BMI (kg/m ²)	38.3 ± 6.4	39.8 ± 6.9	36.4 ± 5.1	0.001
Weight loss (Kg)	25.3±9.9	27.0±10.4	23.2±9.0	0.024
Percent Excess weight loss (%)	56.6±20.2	55.9 ± 22.4	57.5 ± 17.2	0.646
Percent Total Weight Loss (%)	24.0±7.3	24.6±7.7	23.3±6.8	0.295
Weight Loss Success				
≥ 50% excess weight loss	84 (61.3%)	45 (59.2%)	39 (63.9%)	0.573
≥ 25% total weight loss	59 (43.1%)	36 (47.4%)	23 (37.7%)	0.256

*Values are mentioned as mean±standard deviation or number (%).

BMI: Body mass index; ASA: American Society of Anesthesiologists; DM: Diabetes mellitus, type 2

Results

Table 3. 1-year glycemic outcomes after bariatric surgery of type II DM patients

	Total (N=77) *	Sleeve gastrectomy (N=36) *	Roux-en-Y gastric bypass (N=41) *	P value
DM medication (N=77)				0.669
Stopped	54 (70.1%)	26 (72.2%)	28 (68.3%)	
Reduced dose	19 (24.7%)	9 (25.0%)	10 (24.4%)	
Same dose	4 (5.2%)	1 (2.8%)	3 (7.3%)	

*Values are mentioned as mean \pm standard deviation or number (%).

BMI: Body mass index; ASA: American Society of Anesthesiologists; DM: Diabetes mellitus, type 2

Results

Table 4. Analyses of affecting risk factors for successful EWL ≥ 50%

	Univariate			Multivariate		
	OR	95% CI	P value	OR	95% CI	P value
Age (by 60 or more)			0.963			
less than 30	0.813	0.183-3.600	0.785			
30 ~ 39	0.688	0.176-2.684	0.590			
40 ~ 49	0.733	0.187-2.880	0.657			
50 ~ 59	0.950	0.229-3.945	0.944			
Male Sex	1.200	0.565-2.548	0.635	2.580	1.013-6.574	0.047
BMI*	0.872	0.814-0.935	<0.001	0.830	0.764-0.902	<0.001
ASA score (by 2)			0.300			
3	0.500	0.208-1.021	0.121			
4	0.000	0-∞	1.000			
DM	0.916	0.415-2.023	0.828			
Op type (by sleeve)						
RYGB	1.221	0.610-2.446	0.573			
preop HbA1c*	1.079	0.849-1.372	0.532			
preop total cholesterol*	0.998	0.991-1.006	0.689			

Asteroid mark(*) represents continuous variable. OR: odd ratio; CI: confidence interval; BMI: Body mass index; ASA: American Society of Anesthesiologists; DM: Diabetes mellitus; RYGB: Roux-en-Y gastric bypass

Results

Table 4. Analyses of affecting risk factors for successful TWL ≥ 25%

Univariate		OR	95% CI	P value
Age (by 60 or more)				0.946
	less than 30	1.050	0.250-4.417	0.947
	30 ~ 39	1.260	0.339-4.681	0.730
	40 ~ 49	0.852	0.226-3.209	0.813
	50 ~ 59	1.137	0.292-4.437	0.853
Male Sex		0.858	0.411-1.794	0.684
BMI*		1.010	0.957-1.065	0.727
ASA score (by 2)				0.836
	3	1.304	0.546-3.116	0.550
	4	#####	0-∞	1.000
DM		0.464	0.213-1.012	0.054
Op type (by sleeve)				
	RYGB	0.673	0.339-1.336	0.257
preop HbA1c*		0.861	0.676-1.097	0.225
preop total cholesterol*		0.996	0.989-1.004	0.382

Asteroid mark(*) represents continuous variable. OR: odd ratio; CI: confidence interval;
 BMI: Body mass index; ASA: American Society of Anesthesiologists; DM: Diabetes mellitus;
 RYGB: Roux-en-Y gastric bypass

Results

Table 6. Regression analysis between predicted and observed BMI by prediction models

Group	Model	B	95% CI	P value	R	R ²	adjusted R ²	SE	RMSE
All	Baltasar	1.776	1.586-1.967	<0.001	0.846	0.715	0.713	2.86	2.85
	Seyssel	1.221	1.074-1.367	<0.001	0.817	0.668	0.665	3.08	3.08
LSG	Baltasar	1.83	1.572-2.088	<0.001	0.854	0.73	0.726	3.07	3.07
	Seyssel	1.244	1.053-1.435	<0.001	0.833	0.694	0.69	3.27	3.27
LRYGB	Baltasar	1.695	1.367-2.024	<0.001	0.802	0.643	0.637	2.61	2.61
	Seyssel	1.127	0.870-1.383	<0.001	0.753	0.566	0.559	2.87	2.88

BMI: Body mass index; B: regression coefficient; CI: confidence interval; R: Pearson's correlation coefficient; SE: standard error of the estimate; RMSE: root mean square error

Table 7. Comparison of predicted and observed BMI by prediction models

	All		LSG		LRYGB	
	predicted BMI	BMI difference	predicted BMI	BMI difference	predicted BMI	BMI difference
Baltasar	27.06±2.54	-1.98±3.46	27.71±2.74	-2.36±3.83	26.28±2.04	-1.54±2.94
Seyssel	26.44±3.57	-2.60±3.17	27.17±3.91	-2.90±3.39	25.56±2.90	-2.26±2.89

Discussions

- There were some differences in preoperative demographics between Sleeve gastrectomy (SG) and Roux-en Y gastric bypass (RYGB)
 - Elder age & higher preoperative diabetes in RYGB
 - Higher in weight, BMI in SG
- There were no differences in 1-yr successful EWL & TWL outcome between SG & RYGB
 - >50% EWL -> 59.2% in SG and 63.9% in RYGB (P=0.573)
 - >25%TWL -> 47.4% in SG and 37.7% in RYGB (P=0.256)
- In multivariate analysis, male sex (OR = 2.580) and BMI (OR = 0.830) were the independent risk factors for EWL but there was no significant risk factor for TWL
- Both Baltasar's and Seyssel's model were validated to predict 1-year outcome of the patients who underwent bariatric surgery, which could explain 71.3% and 66.5% of the patients with acceptable mean difference between predicted and observed BMIs of -1.98 ± 3.46 vs. -2.60 ± 3.17 , respectively.
- Particularly, mean BMI difference between predicted and observed was smaller in RYGB than SG (-1.54 ± 2.94 vs. -2.36 ± 3.83). This phenomenon may be mainly due to inevitable heterogeneity of operator dependent SG, while RYGB is more standardized procedure.

Conclusion

- Both laparoscopic Sleeve gastrectomy and Roux-en Y gastric bypass were feasible and effective bariatric procedures for weight loss in Korean morbid obesity
- EWL and TWL proved to be similar trends for the success of one-year weight loss, but TWL model appeared to be a criterion that could more accurately predict weight loss without being affected by preoperative weight.
- For Korean obese patients, external validation model could predict the 1-year outcome of both SG & RYGB acceptably and RYGB more accurately.