Diagnosis and management of hypoglycemia after RYGB and OAGB

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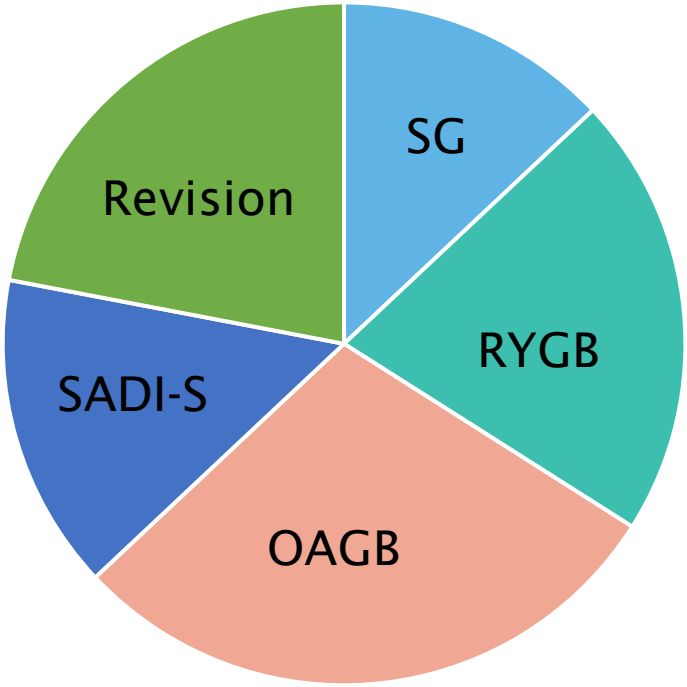
Disclosures

Nothing to disclose

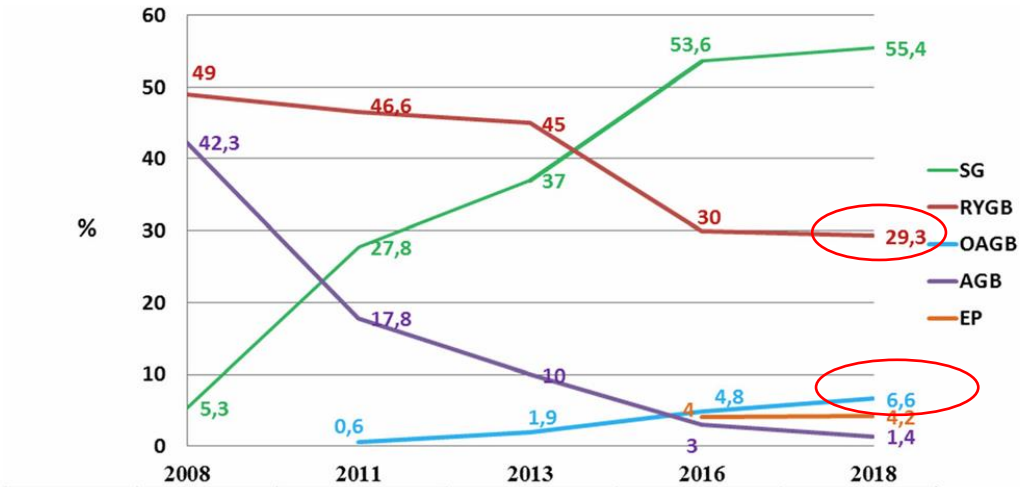
Case mix



LAGB	0%
SG	13%
RYGB	21%
OAGB	29%
SADI-S	15%
Revision	22%

Background

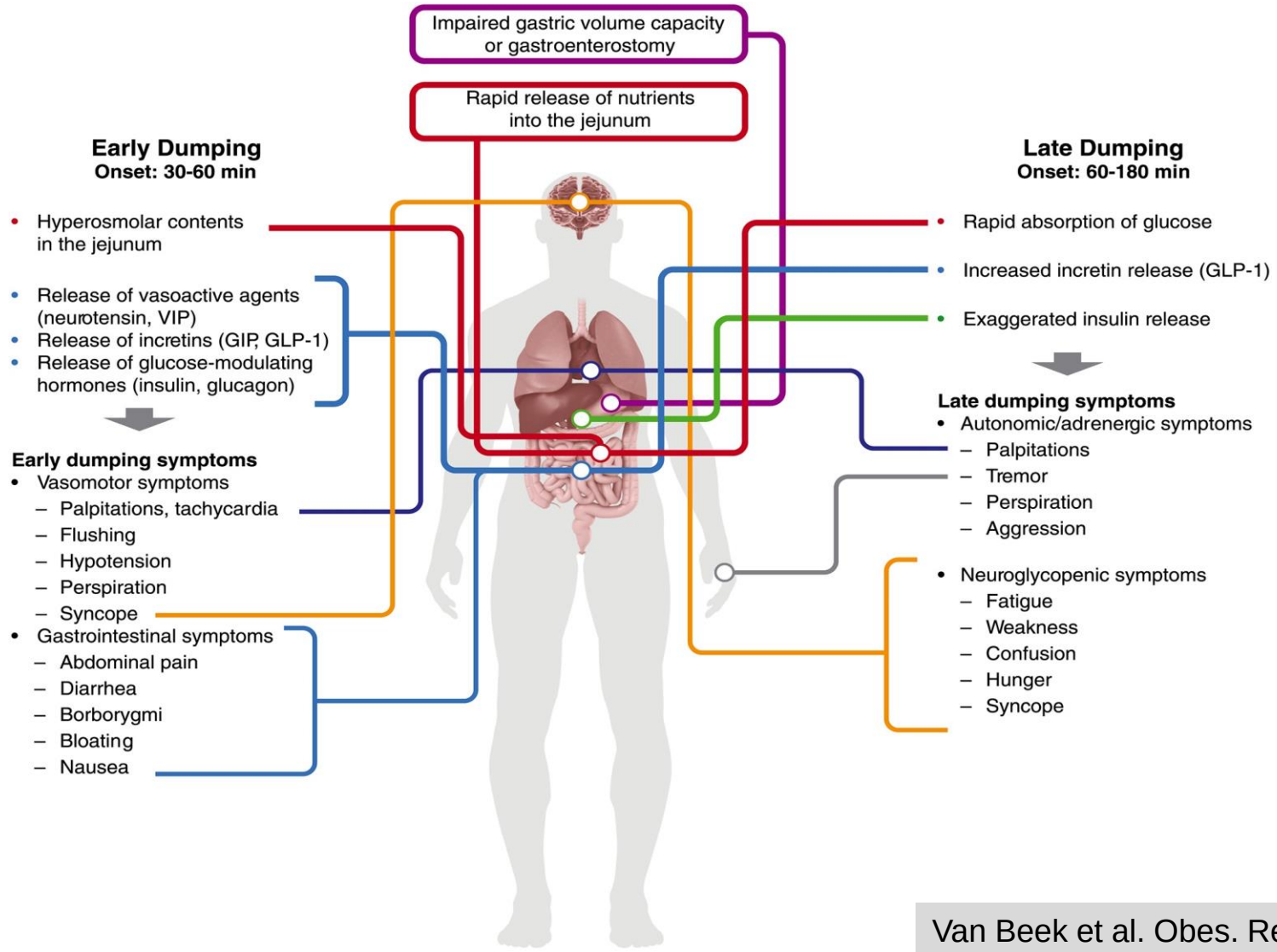
Metabolic / bariatric operations worldwide by 2021



Bariatric procedures (N)	344,221	340,768	468,609	685,874	696,191

Angrisani L. et al. Obes Surg 2024

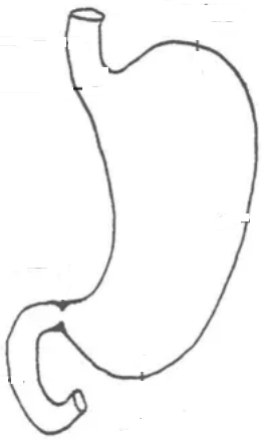
Mechanism



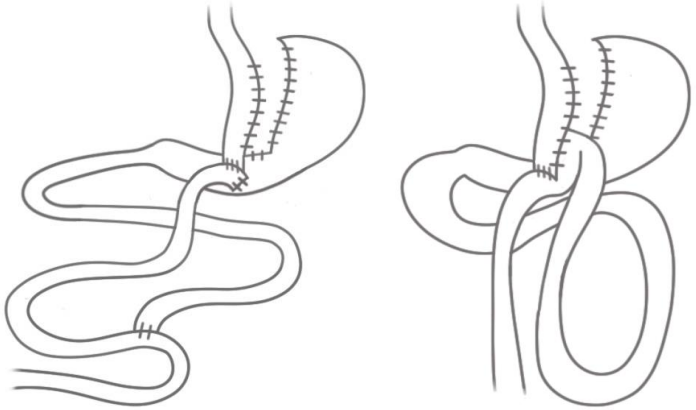
Van Beek et al. Obes. Rev. 2017

Mechanism

Normal stomach



After RYGB and OAGB



Pylorus vs. no pylorus in the food stream

Late dumping after intake of simple carbohydrates due to a hyperinsulinic hypoglycemia

Mechanism

ANNALS OF MEDICINE
2021, VOL. 53, NO. 1, 1885–1895
https://doi.org/10.1080/07853890.2021.1964035

ENDOCRINOLOGY

Computational modelling of self-reported dietary carbohydrate intake on glucose concentrations in patients undergoing Roux-en-Y gastric bypass versus one-anastomosis gastric bypass

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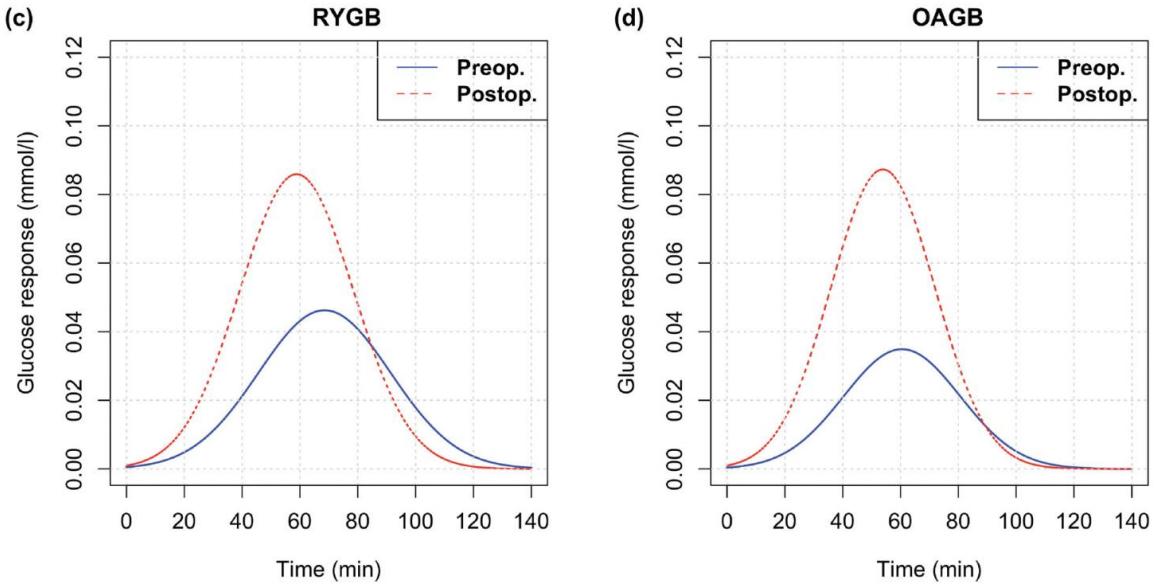


Glucose curves pre- and postoperative after RYGB and OAGB

Ashrafi R. et al. Annals of Medicine 2021

Symptoms

Tiredness

Heart palpitations

Craving for food

Dizziness

Collapse

etc.

Definition

There are different definitions and cut-off levels being used.

<u>Most commonly used:</u>

„**Hypoglycaemia below 50 mg/dl** is suggestive of late dumping syndrome“ (Grade B)

Simpson et al. Am J. Clin. Nutr. 2008

Diagnostics

Sigstad's Scoring System

> 7 points → indicative

< 4 points → unlikely

- Established for Billroth II patients

- Shock +5
- Fainting (syncope), unconsciousness +4
- Desire to lie or sit down +4
- Breathlessness (dyspnoea) +3
- Weakness, exhaustion +3
- Sleepiness, drowsiness, apathy, falling asleep +3
- Palpitation +3
- Restlessness +2
- Dizziness +2
- Headaches +1
- Feeling of warmth, sweating, pallor, clammy skin +1
- Nausea +1
- Abdominal fullness, meteorism +1
- Borborygmus +1
- Eructation −1
- Vomiting −4

Diagnostics

Arts Dumping Severity Score

- Distinguishes between early/late dumping
- Estimation of the severity
- Unclear test accuracy

Early dumping syndrome symptoms
- Sweating
- Flushing
- Dizziness
- Palpitations
- Abdominal pain
- Diarrhoea
- Bloating
- Nausea

Late dumping syndrome symptoms
- Sweating
- Palpitations
- Hunger
- Drowsiness and/or unconsciousness
- Tremor
- Irritability

Severity score

For each symptom: 0 = absent, 1 = mild, 2 = relevant and 3 = severe

Diagnostics

OGTT – Oral glucose tolerance test

Procedure:

Intake of 75g glucose

Measurement of glucose, haematocrit, heart rate, blood pressure in 30 min. intervals for 3h

Early dumping:

- Haematocrit ↑ > 3% or
- Heart rate ↑ > 10 beats/min

< 30 min. after glucose intake

Late dumping:

- **Blood glucose < 50 mg/dl**

> 1h after glucose intake

Diagnostics

MMTT – Mixed meal tolerance test

Procedure:

- Intake of a standardized meal in 20 min.
- ~460 kcal; ~14 g fat, ~60 g carbohydrates (20 g simple sugars), 16 g protein

Late dumping:

- **Blood glucose < 50 mg/dl**

> 1h after glucose intake

Diagnostics

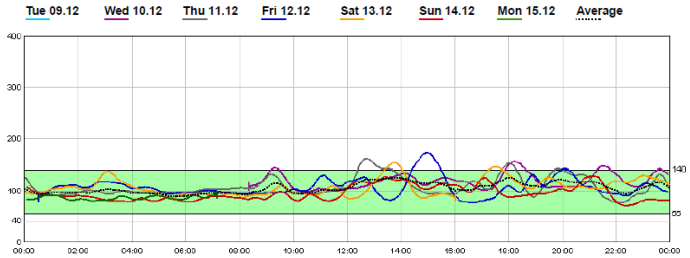
CGM – Continuous glucose monitoring

Procedure:

Measurement of subcutaneous blood glucose levels for several days

Combination with a food logbook

Sensor Data (mg/dL)



	Tue 09.12	Wed 10.12	Thu 11.12	Fri 12.12	Sat 13.12	Sun 14.12	Mon 15.12	Average / Total
# Sensor Values	0	188	288	283	280	288	86	1.413
Highest	N/A	155	161	171	153	128	92	171
Lowest	N/A	97	76	77	84	70	80	70
Average	N/A	119	108	107	107	95	86	105
Standard Dev.	N/A	15	18	18	16	15	4	18
MAD %	N/A	9,7	1,4	3,8	6,1	16,5	N/A	8,0
Correlation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
# Valid Calibrations	0	3	2	3	3	3	0	14
Designation	S		X				C	

X: Use Clinical Judgment S: No Sensor Data C: No Calibration BG's

Excursion Summary (mg/dL/day)

	Tue 09.12	Wed 10.12	Thu 11.12	Fri 12.12	Sat 13.12	Sun 14.12	Mon 15.12	Average / Total
# Excursions	0	4	3	2	2	0	0	11
# High Excursions	0	4	3	2	2	0	0	11
# Low Excursions	0	0	0	0	0	0	0	0
AUC Above Limit	N/A	0,7	0,7	0,9	0,3	0,0	0,0	0,5
AUC Below Limit	N/A	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Duration Distribution (hh:mm)

Above 140	N/A	1:40	11%	2:05	9%	1:20	6%	1:10	5%	0:00	0%	0:00	0%	6:15	5%
Within (55 - 140)	N/A	14:00	89%	21:55	91%	22:15	94%	22:10	95%	24:00	100%	7:10	100%	111:30	95%
Below 55	N/A	0:00	0%	0:00	0%	0:00	0%	0:00	0%	0:00	0%	0:00	0%	0:00	0%

Hypoglycemia after Roux-En-Y gastric bypass: detection rates of continuous glucose monitoring (CGM) versus mixed meal test

Ronald Kefurt, M.D.[a], Felix B. Langer, M.D.[a], Karin Schindler, Ph.D.[b], Soheila Shakeri-Leidenmühler, M.D.[a], Bernhard Ludvik, M.D.[b], Gerhard Prager, M.D.[a,*]

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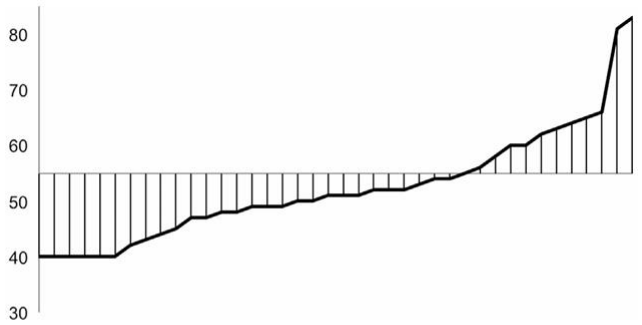


Fig. 2. Lowest blood glucose levels detected by continuous glucose monitoring (CGM) in the series of 40 patients after a Roux-en-Y gastric bypass. Blood glucose levels of below 40 mg/dl (2.2 mmol/L) are expressed as 40 mg/dl (2.2 mmol/L).

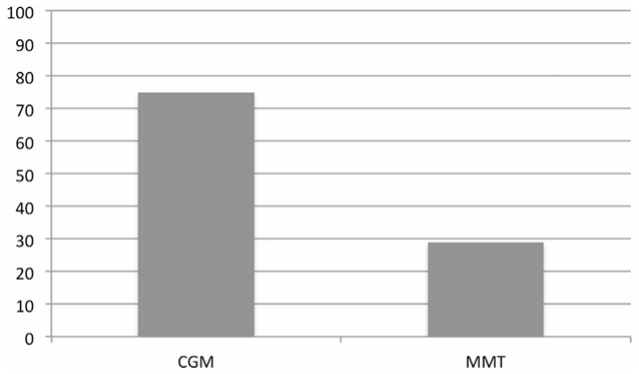


Fig. 1. Detection rates (%) of post-gastric bypass hypoglycemic episodes comparing CGM (continuous glucose monitoring), MMT (mixed meal test). **CGM** continuous glucose monitoring **MMT** mixed meal tolerance test

40 patients after RYGB

Higher detection rates of hypoglycaemia with CGM than with MMTT

Over 75% patients with hypoglycaemic episodes after RYGB

Kefurt R. et al. SOARD 2014

Conservative therapy

Dietological interventions

First-line intervention - usually beneficial for the majority of patients

Multiple small meals during the day

Liquid intake after a minimum of 30 mins following meal

No simple carbohydrates! Intake of complex carbohydrates

Increasing fibres and protein in one's diet

Slow food intake and good chewing

Avoiding alcoholic drinks

Conservative therapy

Arcarbose

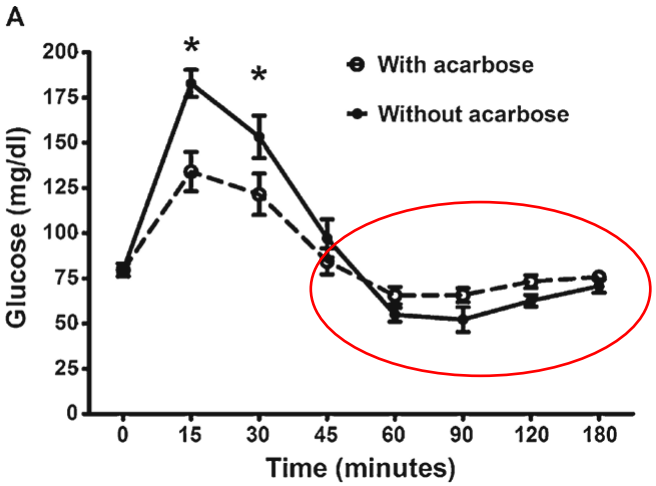
α-glucosidase-inhibitor

Inhibits the hydrolysis of oligo-, tri- and disaccharides to monosaccharides → reduction of blood glucose after food intake

Gastrointestinal side effects due to fermentation in the bowel

5 patients
Hypoglycaemia after RYGB

Improvement in all patients



Valderas J.P. et al. Obes. Surg 2012

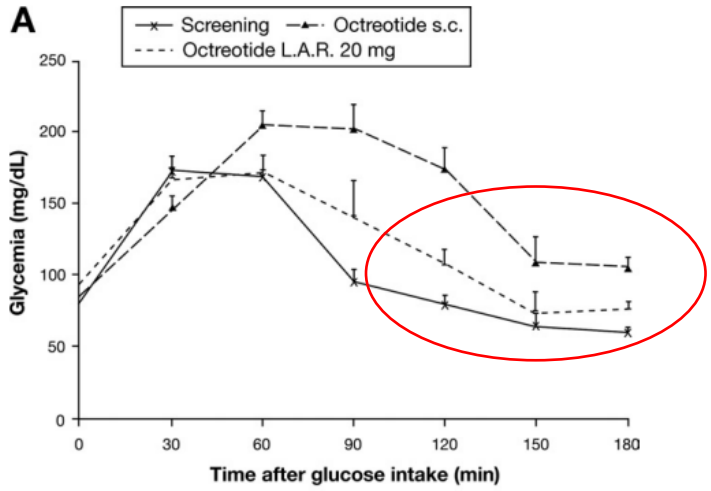
Conservative therapy

Somatostatin analogues (e.g. Octreotid)

Daily s.c. or monthly i.m.

Decreases stomach emptying and small bowel transition, inhibits secretion of gastrointestinal hormones

Gastrointestinal side effects, recurrent weight gain.



Arts E. et al. Clinical Gastroenterology and Hepatology 2009

Conservative therapy

GLP-1 agonist (e.g. Liraglutide)

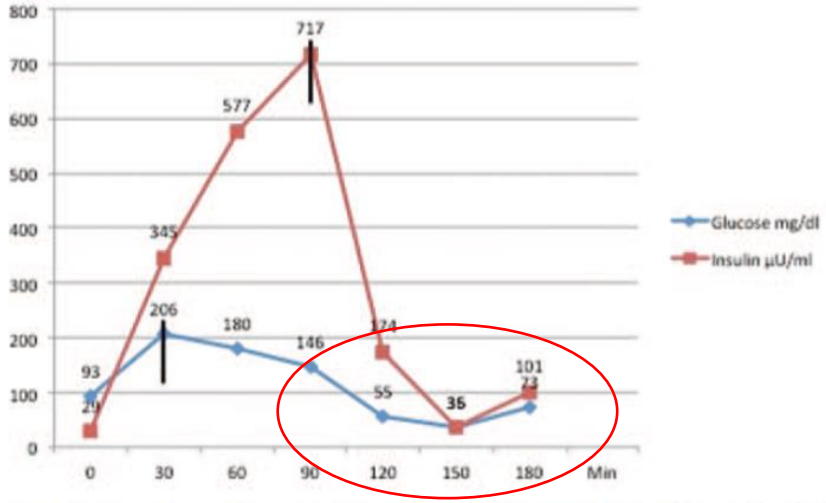


Figure 1. The dynamics of insulin release during OGTT without liraglutide treatment. Note the lack of synchronization of the peak of insulin release to that of serum glucose level.

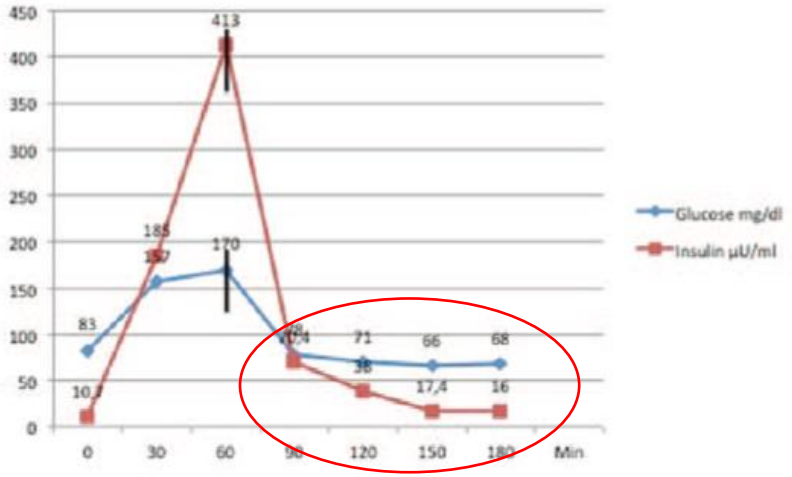


Figure 2. Relationship between the dynamics of insulin release during the OGTT with 1.2 mg liraglutide treatment. Note the optimal synchronization of the peaking of both serum glucose and insulin levels. The rapid decline in insulin output led to a rapid stabilization of serum glucose level and resolution of late dumping symptoms.

OGTT without GLP-1

OGTT with GLP-1

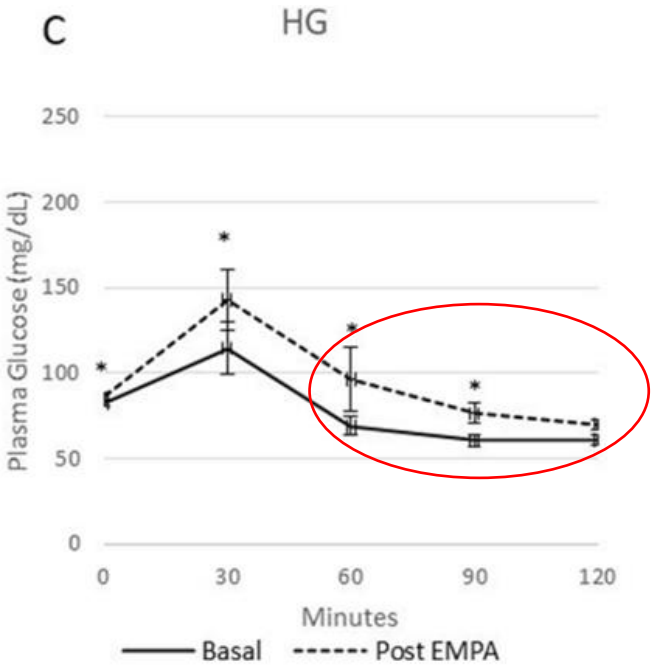
Lower insulin peak with GLP-1
Improvement of late dumping after gastric surgery

Chiapetta S. et al. Medicine 2017

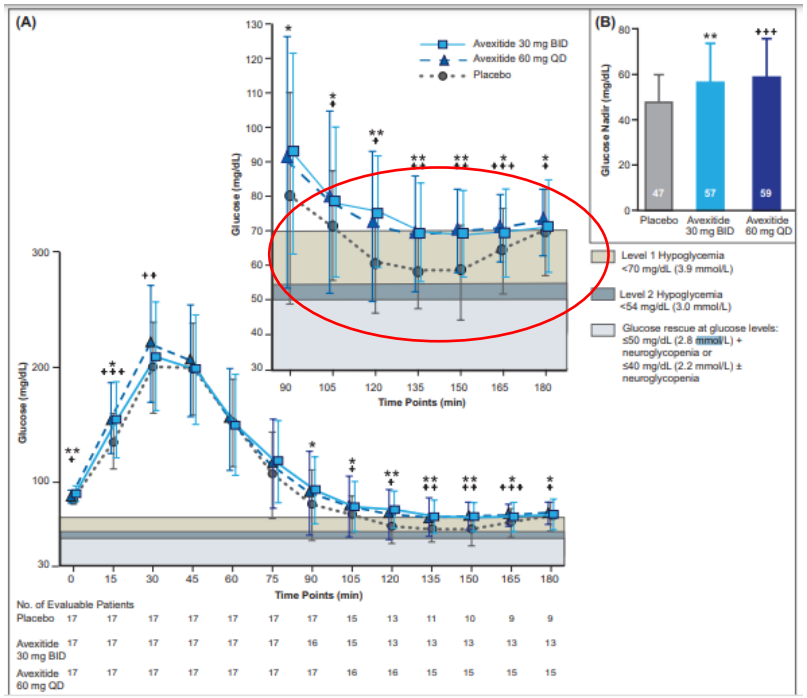
Conservative therapy

Further treatment:

SGLT-2 inhibitor

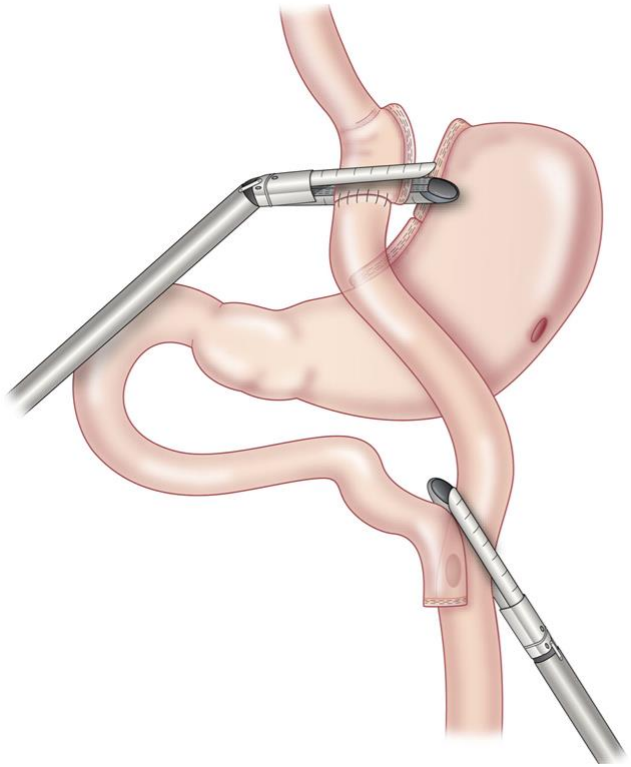


GLP-1 antagonist (e.g. Avexitide)



Carpentiri G. et al. Obes. Surg 2022
Craig et.al. /Prevent study J. Clin. Endocrinol. Metabol. 2021

Surgical treatment



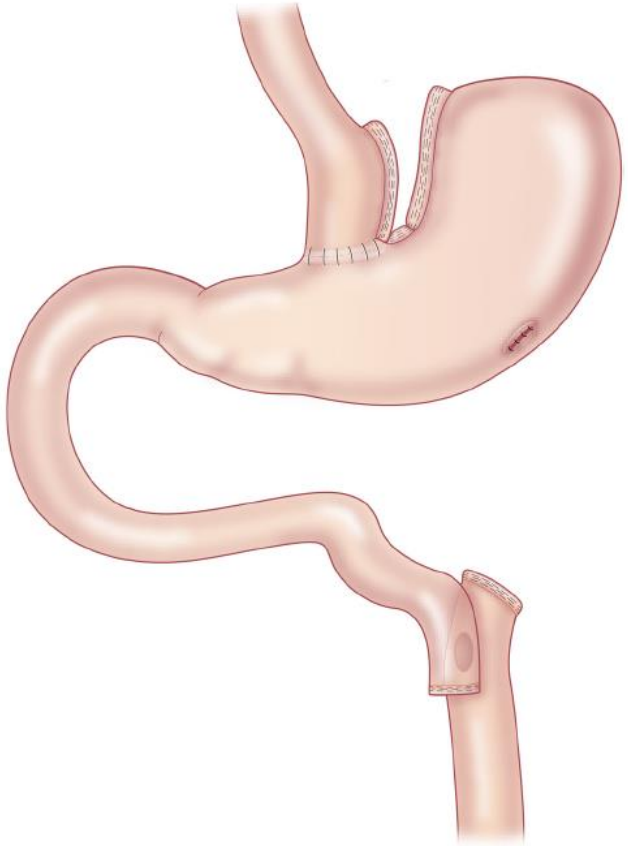


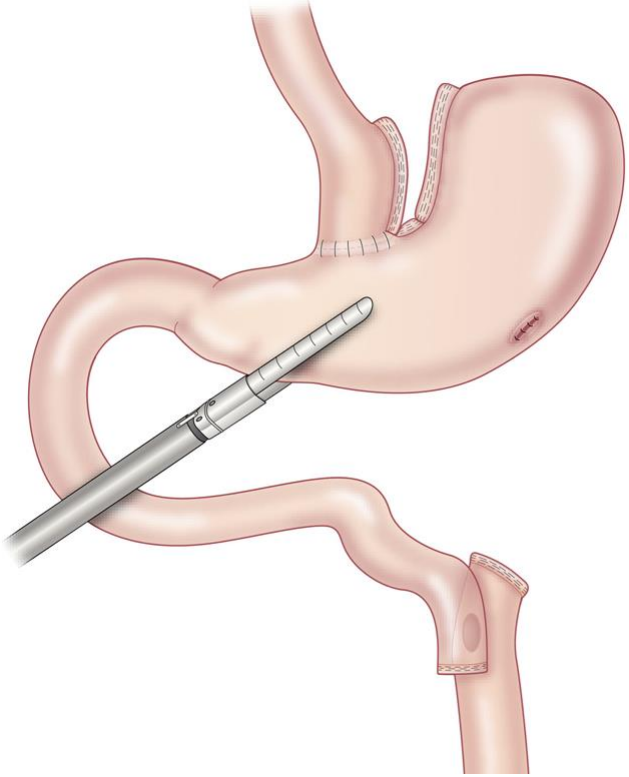
Fig. 3. Final aspect—laparoscopic reversal to normal anatomy.

5 patients

12 months follow-up

Campos G. et al. SOARD 2014

Surgical treatment



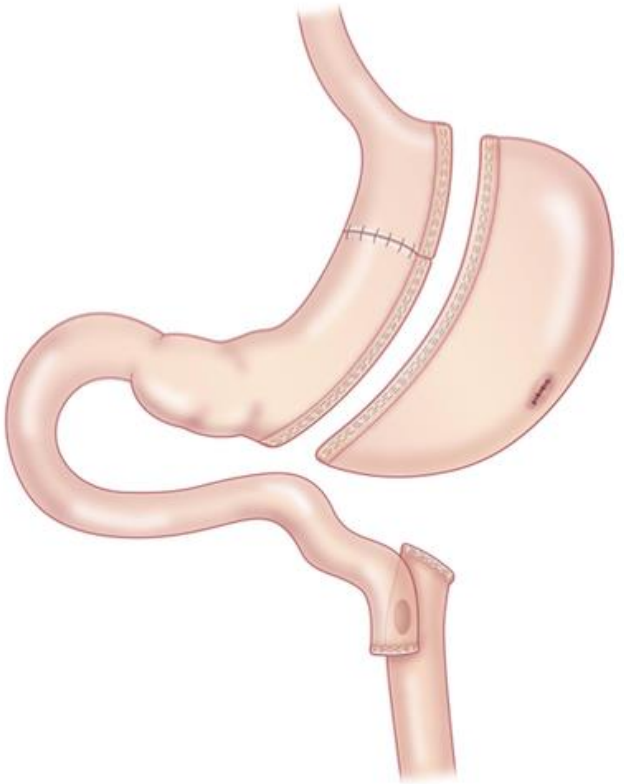
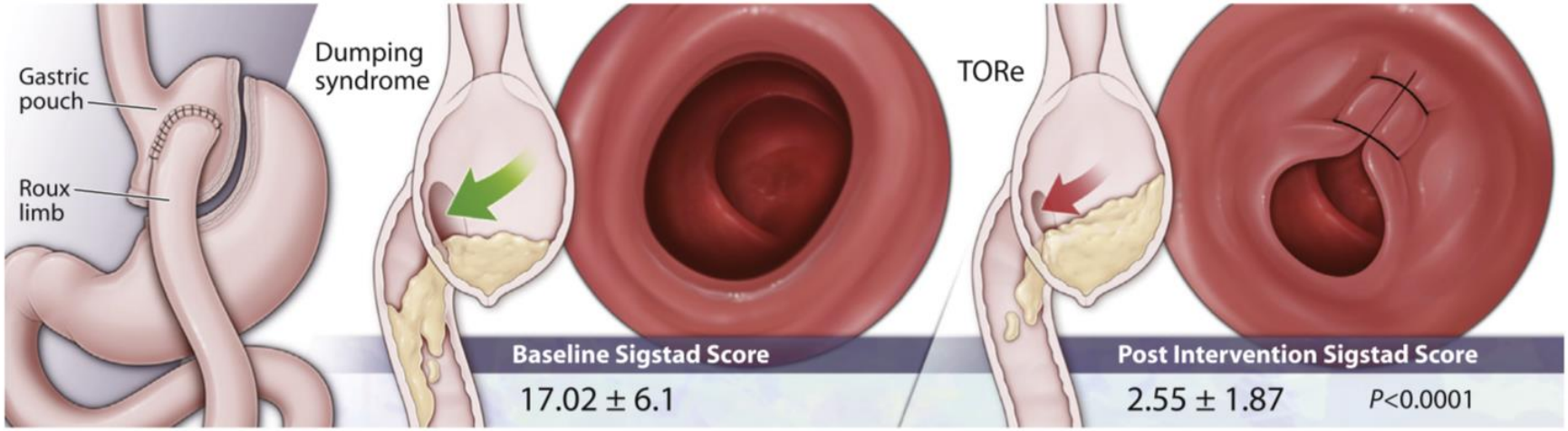


Fig. 5. Final aspect – laparoscopic reversal to modified sleeve gastrectomy (excised stomach is then removed from the abdominal cavity).

Hypoglycemic episodes per week decreased from 18.5 to 1.5

Campos G. et al. SOARD 2014

Endoscopic treatment



115 patients

Reduction of the anastomosis to 10mm

Only 3 months follow-up

Outcome:

Significant postinterventional reduction of the Sigstad score

Vargas et al, Gastroint Endoscopy 2020

Obesity Surgery
https://doi.org/10.1007/s11695-023-06814-w

LETTER TO THE EDITOR

Potential Risk of Hypoglycaemia in Gastric Bypass Patients with Their Profession in Public Transportation System

D. M. Felsenreich[1] · G. Prager[1] · S. Chiappetta[2] · C. Stier[3]

Selection of the **best metabolic / bariatric procedure** for the individual patient:

Procedures with the **pylorus in the food stream** for patients with their profession in the public transportation system

Felsenreich DM. et al. Obes Surg. 2023

Conclusion:

There are different diagnostic tools for the detection of hypoglycaemia available

CGM seems to be the best option for the diagnosis of hypoglycaemia after MBS

Dietological intervention (+ medical therapy) is mostly successful in the treatment of hypoglycaemia

If conservative treatment fails, surgical (bringing the **pylorus** back **to the food stream)** or endoscopic interventions are promising options.

Thank you for your attention!

Gerhard Prager

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