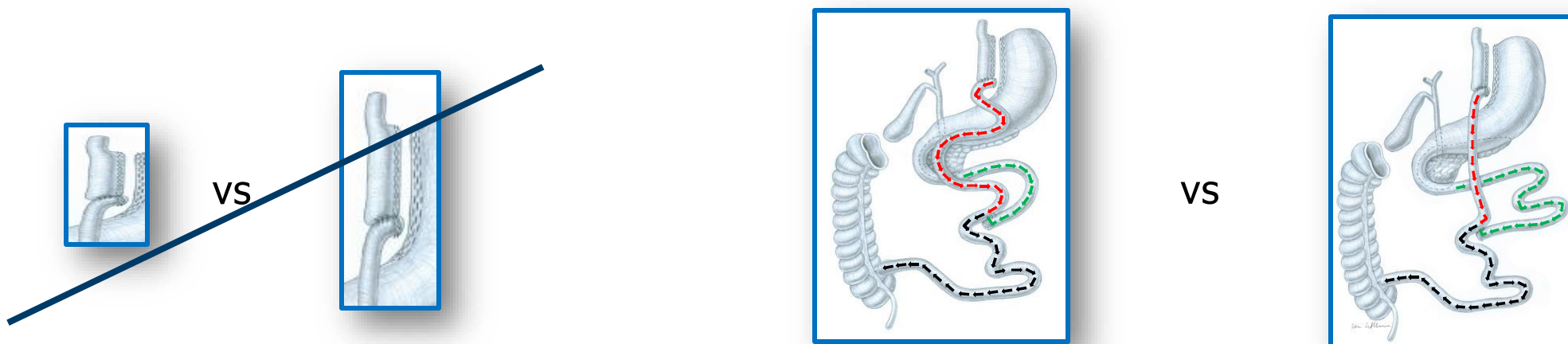


What do we not know in Roux-en-Y Gastric Bypass ?

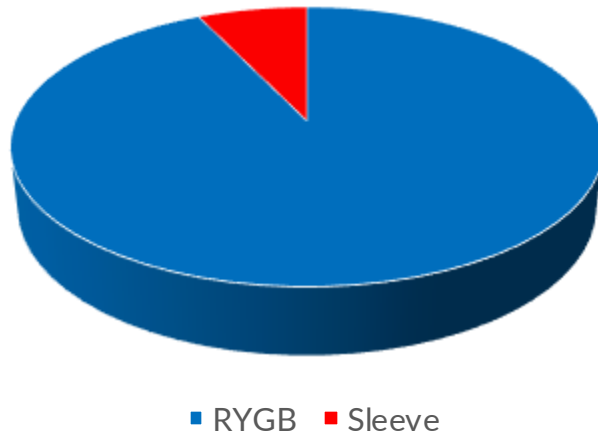


Prof. Ralph Peterli
Department of Clinical Research University of Basel, Switzerland
Senior Consultant Visceral Surgery: ViszeraMed Zürich & Spital Männedorf

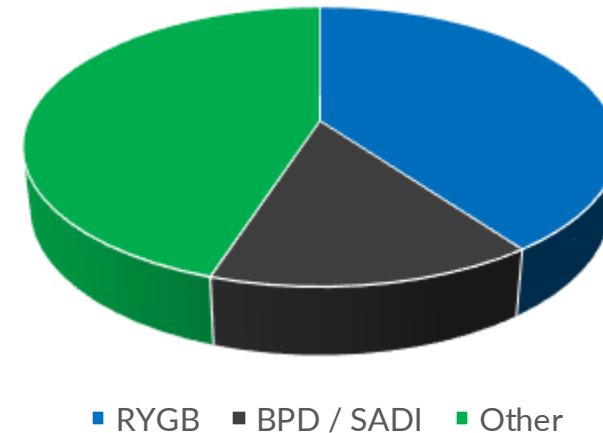
DISCLOSURES

- Research grants: Swiss National Science Foundation, Johnson & Johnson, Hirzbrunnen Foundation
NovoNordisk, UKBB, Novartis
- Lecture/consulting fees: Johnson & Johnson, Viatris, Falk Foundation, NovoNordisk, Lilly, Medtronic
- Case mix disclosure

Primary Procedures

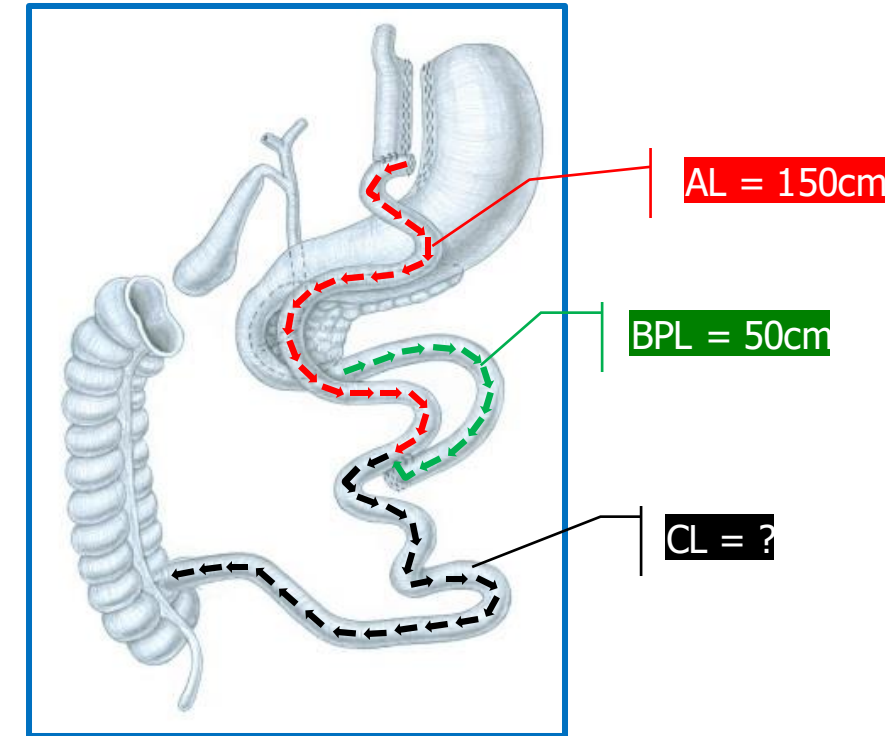
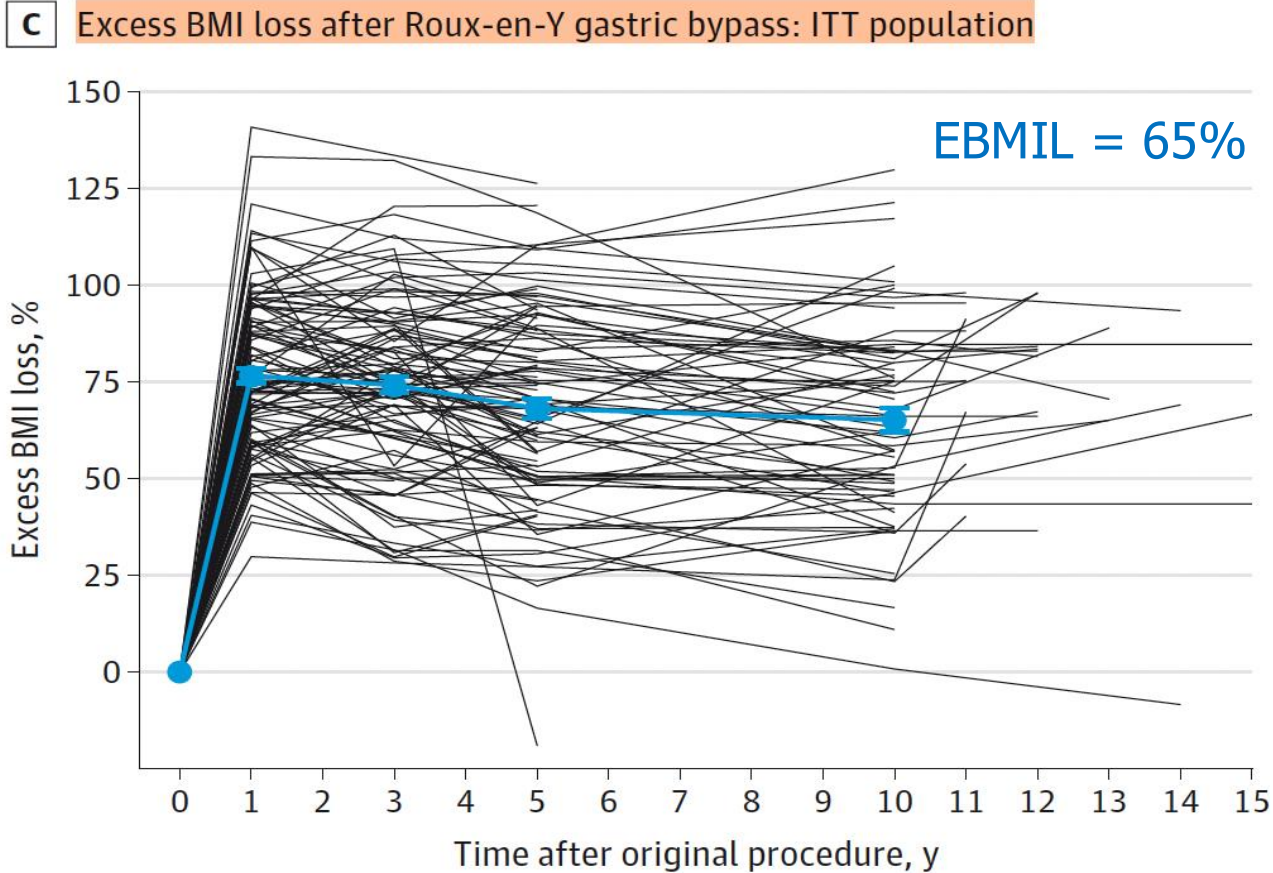


Revisional Procedures



BACKGROUND *Variety of Weight loss Results in highly standardized LRYGB*

- SM-BOSS → LSG vs LRYGB (110 vs 107 patients) > 10y

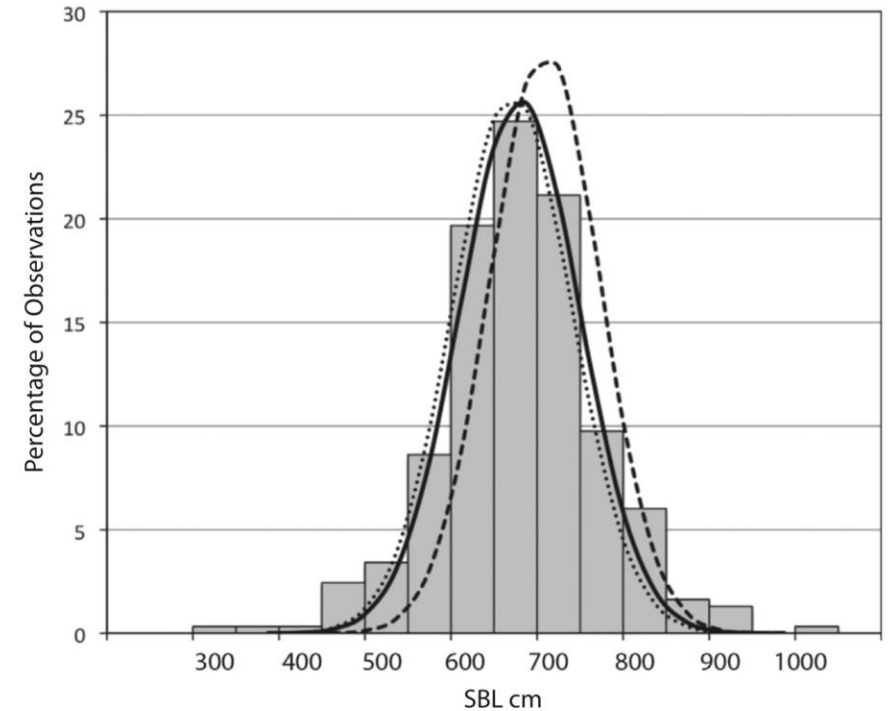


Kraljevic & Peterli, JAMA Surg 2025

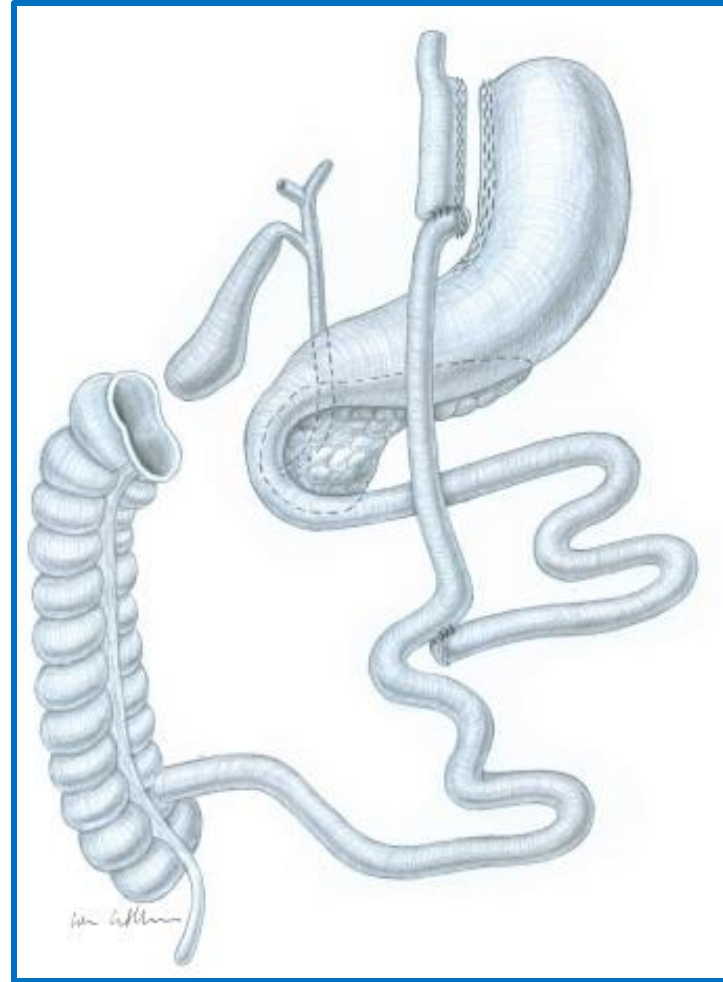
Variety of Total Small Bowel Length

- N = 443: $690 \pm 94\text{cm}$ (350 – 1050cm)
 - Correlates with height (not weight)
 - Male > female (730cm vs 680cm, $p < 0.0001$)
 - Depends on measuring method:
 - Open: with/without ruler
 - Laparoscopy: measure band, marked forceps (5 or 10cm)
 - With/without tension

Tacchino, SOARD 2014

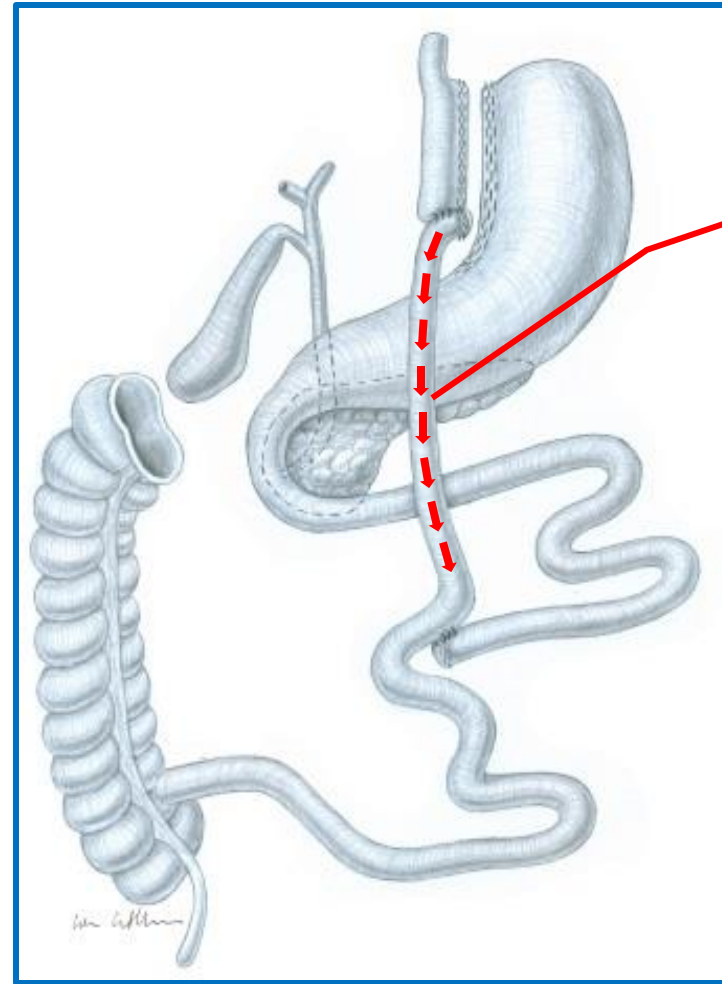


Ways to improve the effectiveness of RYGB



Ways to improve the effectiveness of RYGB

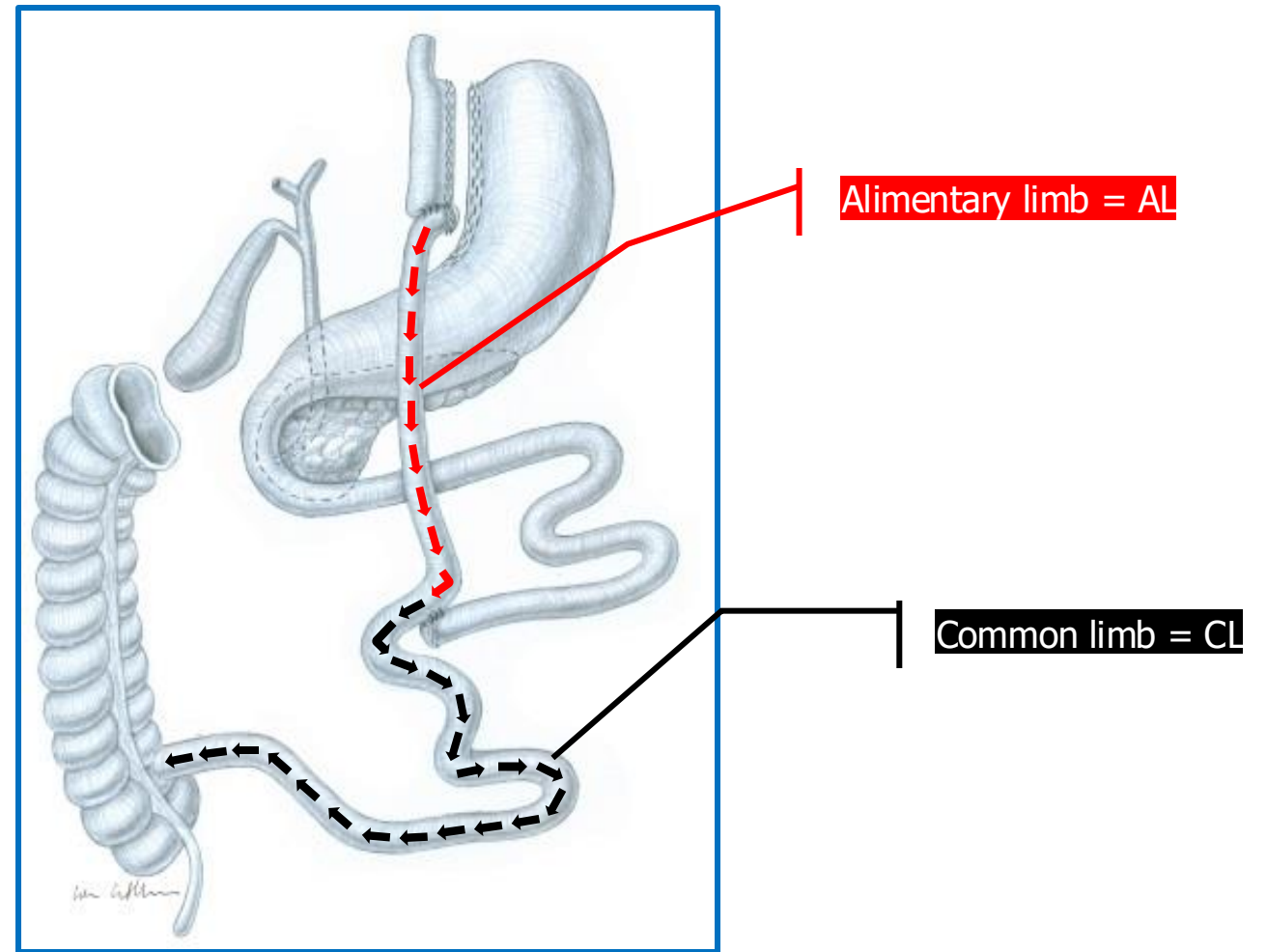
1. Lengthening of alimentary limb (AL)



Alimentary limb = AL

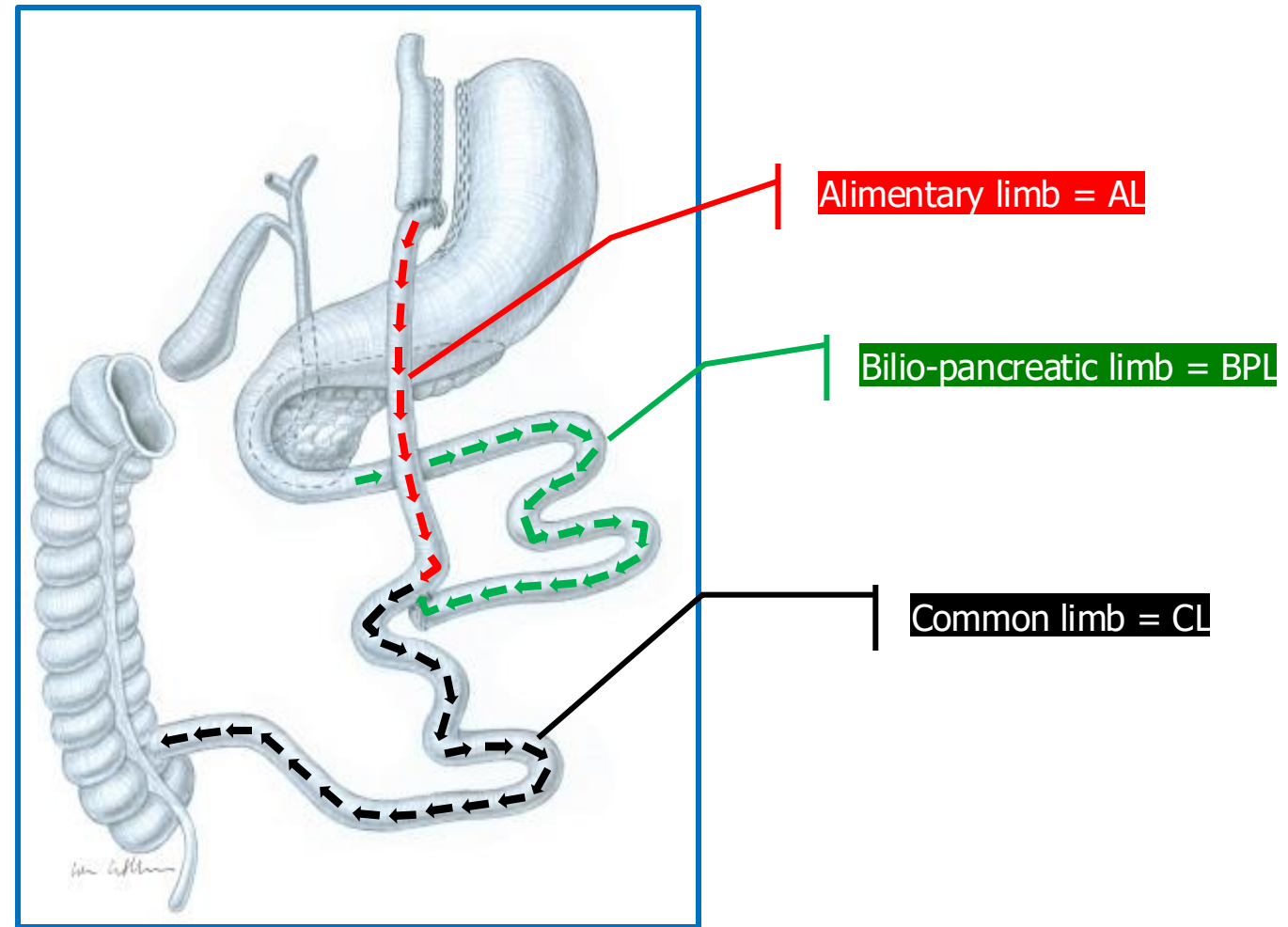
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1. Lengthening of **alimentary limb (AL)**
2. Shortening of **common limb (CL)**



Ways to improve the effectiveness of RYGB

1. Lengthening of **alimentary limb (AL)**
2. Shortening of **common limb (CL)**
3. Lengthening of **bilio-pancreatic limb (BPL)**



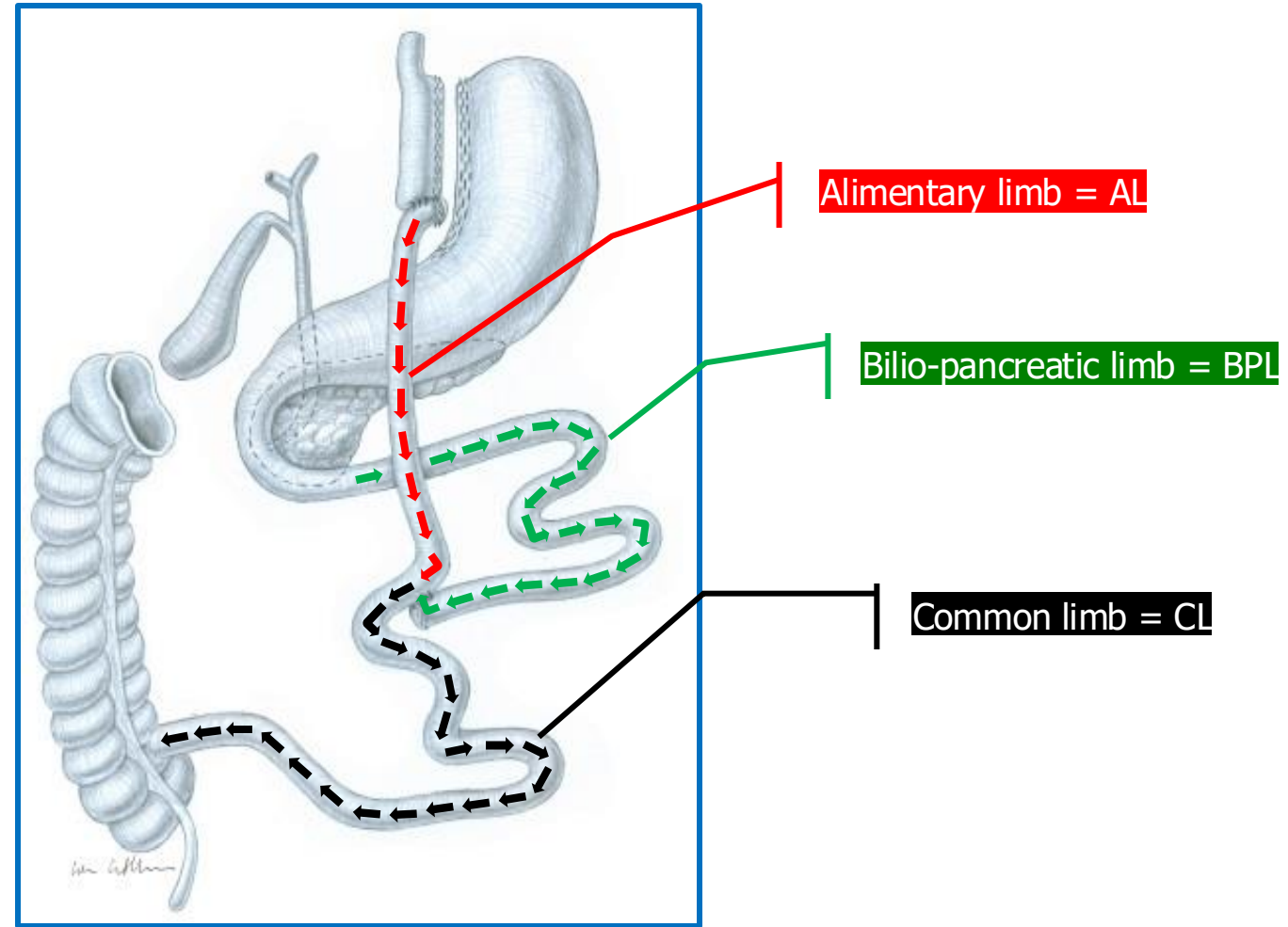
Ways to improve the effectiveness of RYGB

1. Lengthening of **alimentary limb (AL)**
2. Shortening of **common limb (CL)**
3. Lengthening of **bilio-pancreatic limb (BPL)**

The length of one limb:

- Influences the length of the other(s)
- Its effect cannot be analysed without knowledge of the other two
- Consequence:
Total bowel length has to be known

AL & **CL** = total alimentary limb (TAL)

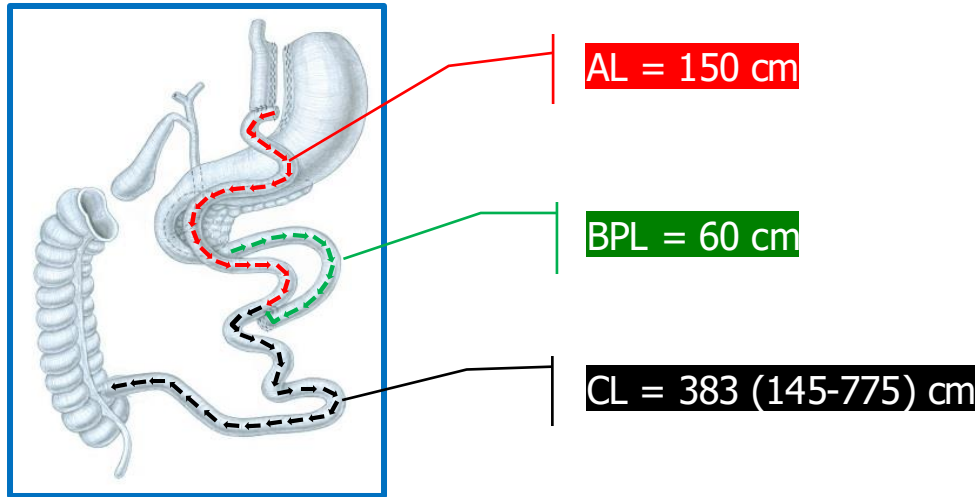


1. Modification of the alimentary limb (AL) in RYGB

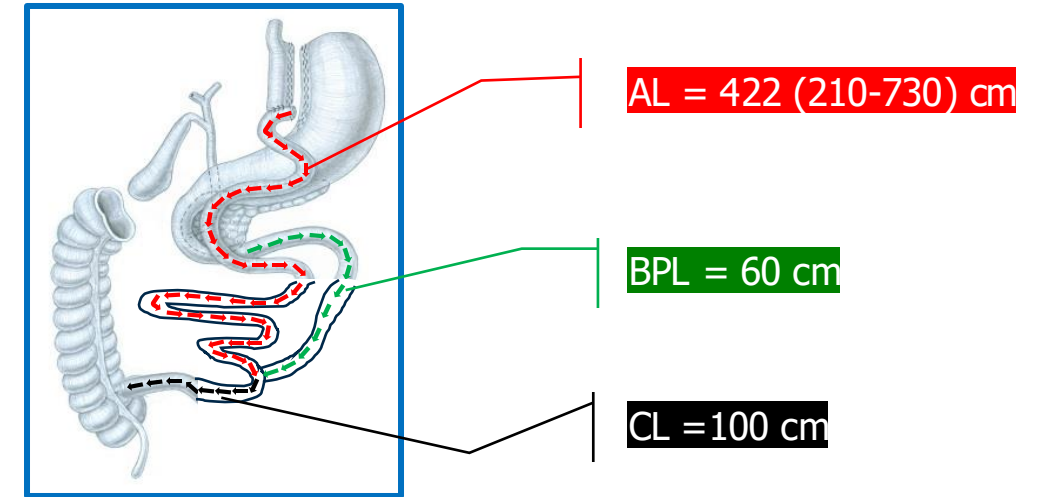
1. Modification of the alimentary limb (AL) in RYGB

DUCATI Trial: RCT, N=444

Standard-LRYGB



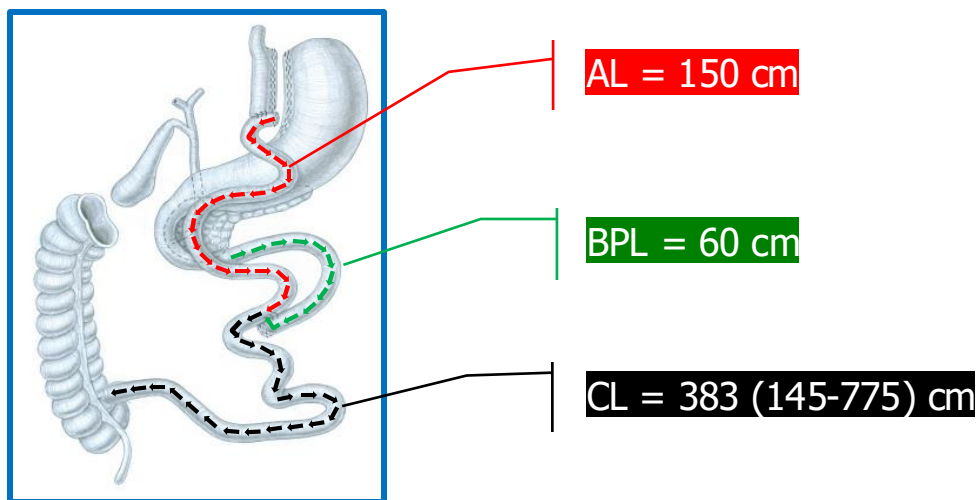
VLRL-LRYGB



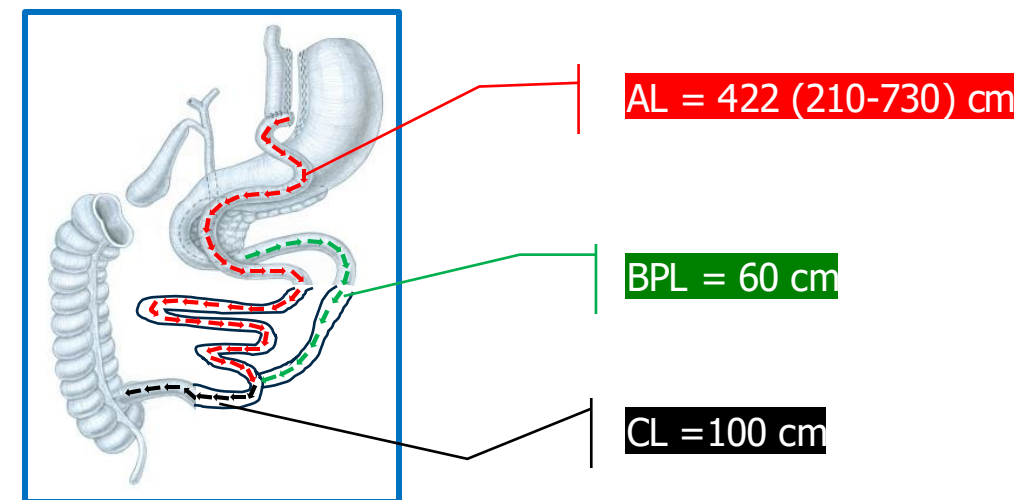
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DUCATI Trial: RCT, N=444

Standard-LRYGB



VLRL-LRYGB



- % EWL 5y 70%
- T2DM remission 51% (FU rate 70%)
- Complications 10%
 - Malabsorption 0.9%

81% ($p=0.002$)

75% (FU rate 97%) (*NS*)

20% ($p=0.005$)

3.6% ($p=0.056$)

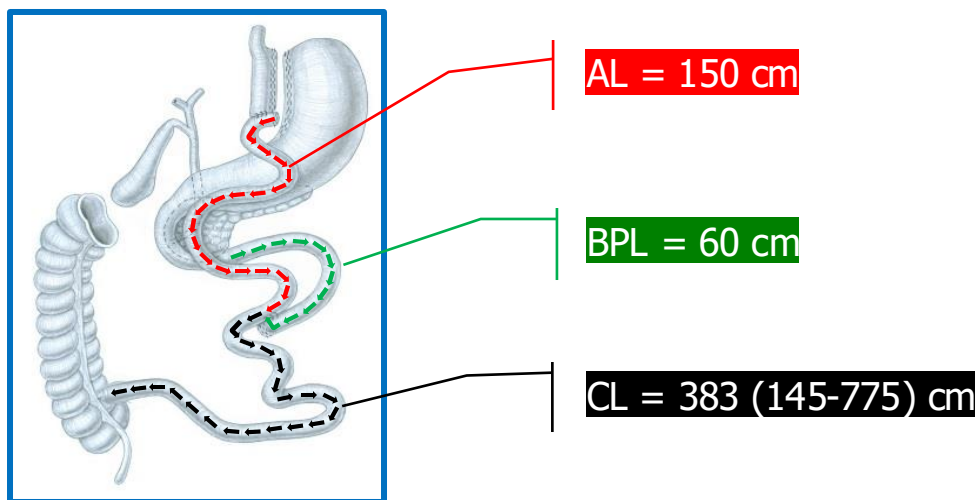


bowel adjustment

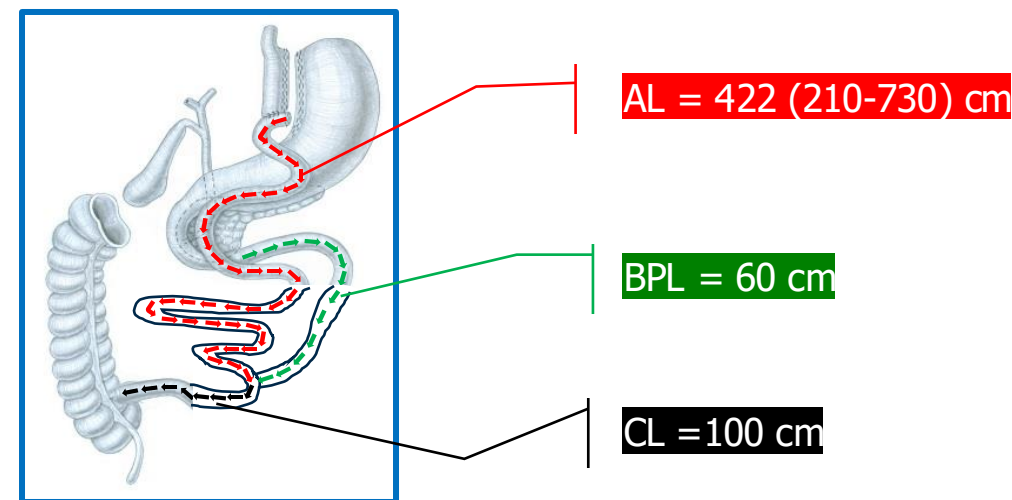
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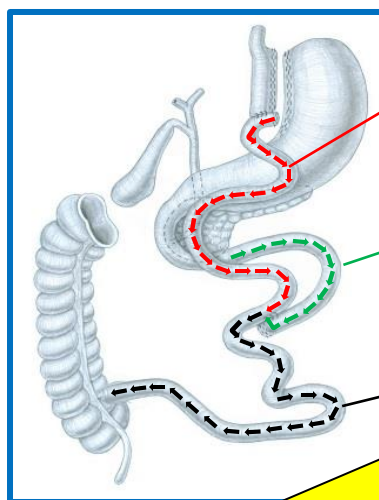
bowel adjustment

Vitamine deficiencies, Diarrhea, Liver cirrhosis, Oxalate-nephropathy

1. Modification of the alimentary limb (AL) in RYGB

DUCATI Trial: RCT, N=444

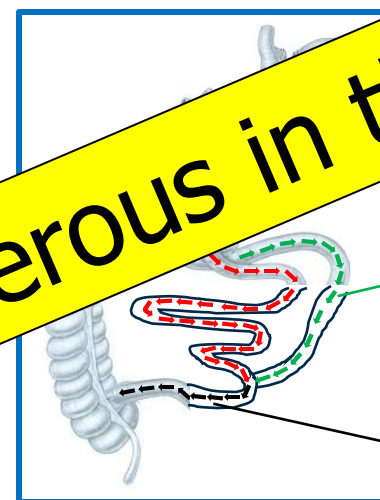
Standard-LRYGB



AL = 150 cm

BPL = 60 cm

VLRL-LRYGB



AL = 422 (210-730) cm

BPL = 60 cm

CL = 100 cm

- % EWL 5y
- T2DM remission rate 70%

10%
0.9%

81% ($p=0.002$)

75% (FU rate 97%) (*NS*)

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3.6% ($p=0.056$)



bowel adjustment

Lengthening of AL can be dangerous in the long run

2. Modification of the **Common limb** in RYGB

2. Modification of the Common limb in RYGB

REVIEW ARTICLE



Accepted for publication 27 November 2022.

Optimal common limb length in Roux-en-Y gastric bypass surgery: is it important for an ideal outcome? – a systematic review

Amy Hort *,† Qiuze Cheng,‡ Tia Morosin ,* Peter Yoon* and Michael Talbot‡

*Department of Surgery, Westmead Hospital, Sydney, New South Wales, Australia

†Department of Surgery, The School of Medicine, The University of Sydney, Sydney, New South Wales, Australia and

‡UNSW St George and Sutherland Clinical School, Sydney, New South Wales, Australia

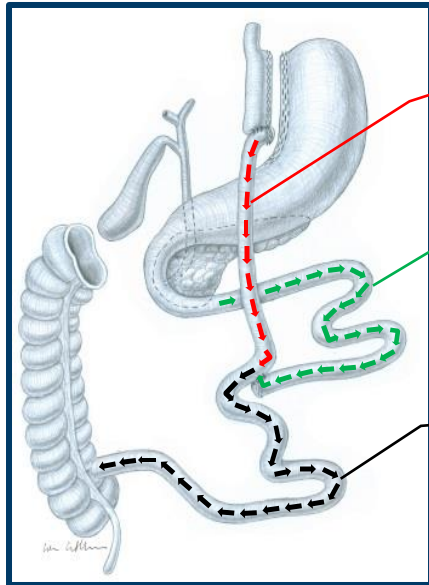
- Meta Analysis (N = 13 trials, 1934 pts)
- CL 75cm – 600cm
- Results:
 - Δ in CL does not change weight loss
 - Shorter CL: better metabolic effect
 - But more deficiencies
 - Up to 48% protein deficiency in distal bypass
- Conclusion:
 - Common limb > 400cm = safe & effective
 - Reasonable weight loss
 - Positive impacts on metabolic outcomes
 - Without severe nutritional deficiencies
 - Surgeons must consider
 - Measuring TBL in all/selected patients
 - CL in revisional cases

3. Modification of the biliopancreatic limb in RYGB

3. Modification of the biliopancreatic limb in RYGB

RCT #1: Long vs. Short (Elegance Trial)

Long (n = 67)

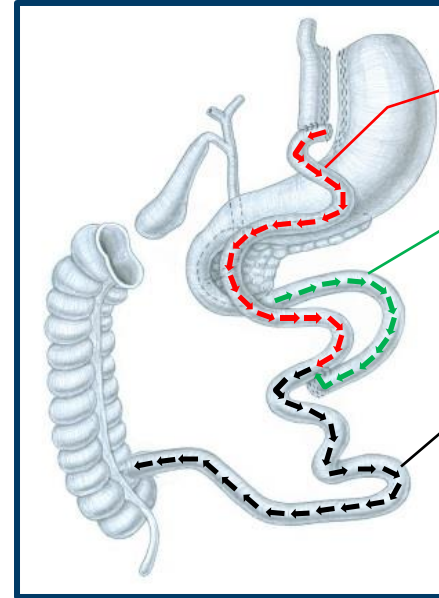


AL = 75cm

BPL = 150cm

CL ?

Short (n = 74)



AL = 150cm

BPL = 75cm

CL ?

FU 91% at 4y

Homann & Berends, Obes Surg 2018

3. Modification of the biliopancreatic limb in RYGB

RCT #1: Long vs. Short (Elegance Trial)

		Long BPL	Short BPL	P-value
BMI baseline		43	45	n.s.
%TWL	1 y	33	32	0.042
	4 y	30	27	0.15
%EWL	1 y	81	71	0.007
	4 y	72	64	<0.05
Improved Dyslipidemia %		95	83	0.02
Complications %	early	10	5	n.s.
	late	28	30	n.s.

Homann & Berends, Obes Surg 2018

3. Modification of the biliopancreatic limb in RYGB

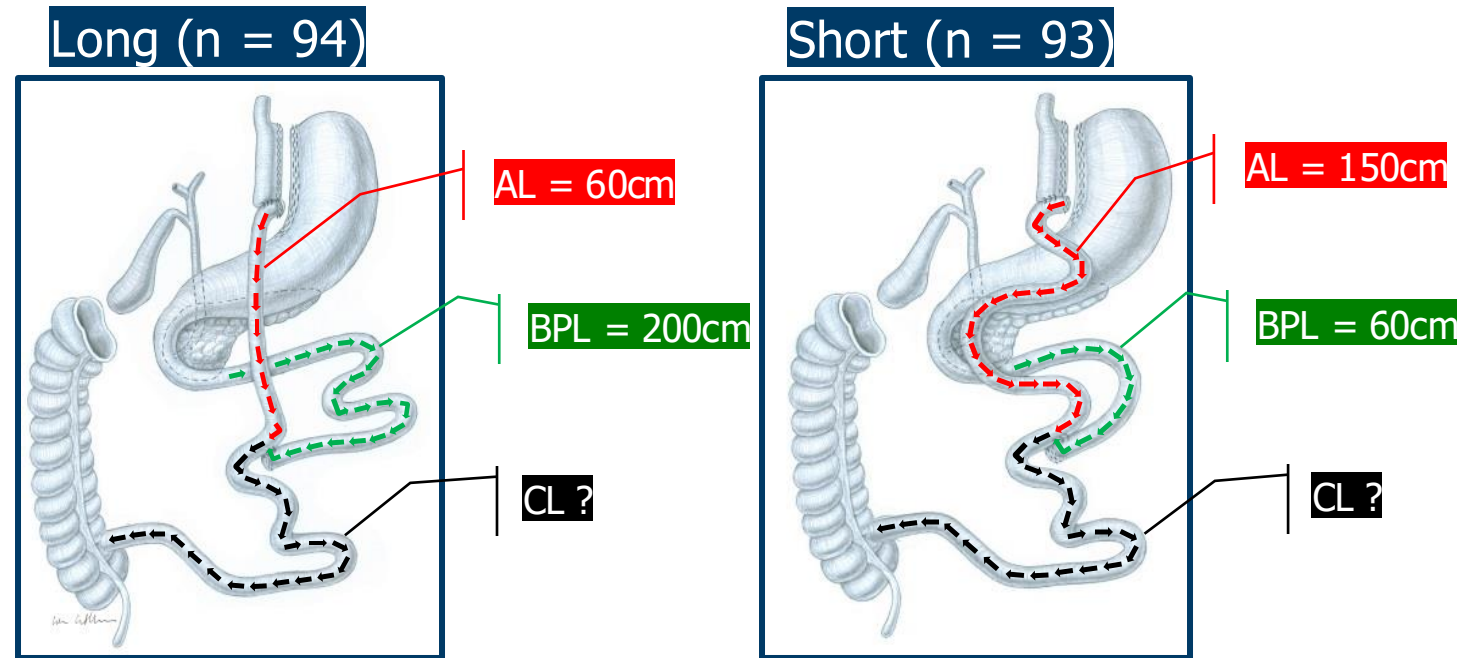
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Improved Dyslipidemia %		95	83	0.02
Complications %	early	10	5	n.s.
	late	28	30	n.s.

- No difference in improvement of T2DM, arterial hypertension
- Vitamine deficiencies not reported
- Total bowel length not measured

3. Modification of the biliopancreatic limb in RYGB

RCT #2: Long vs. Short

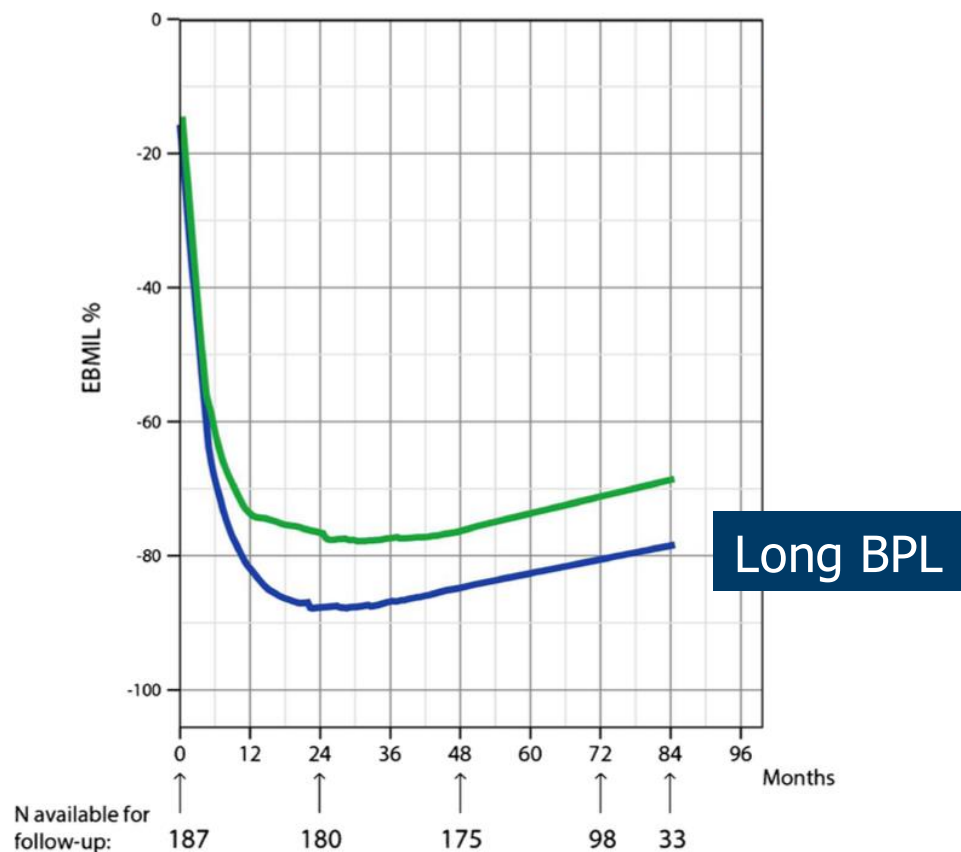


Nergaard & Gislason, Obes Surg 2014

3. Modification of the biliopancreatic limb in RYGB

RCT #2: Long vs. Short

- BMI 44
- FU 85% at 5y



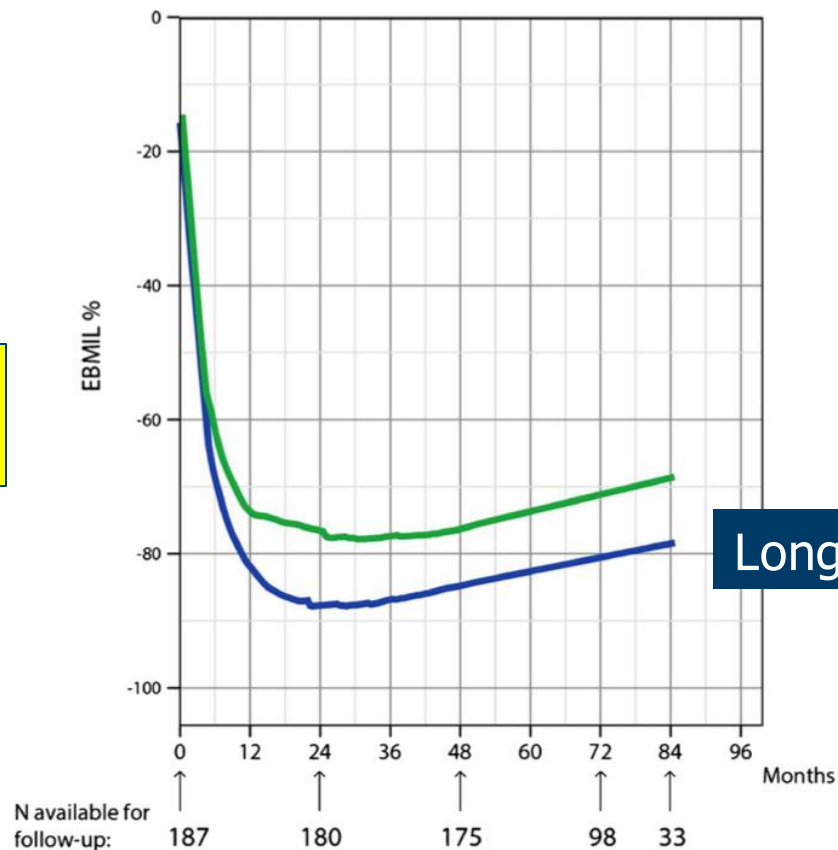
Nergaard & Gislason, Obes Surg 2014

3. Modification of the biliopancreatic limb in RYGB

RCT #2: Long vs. Short

- BMI 44
- FU 85% at 5y

- No difference in improvement of obesity-associated complications



Nergaard & Gislason, Obes Surg 2014

3. Modification of the biliopancreatic limb in RYGB

RCT #2: Long vs. Short

Table 4 Nutritional parameters outside reference values, number of patients (%)

	Before surgery	3 to 9 years after surgery (<i>n</i> = 177), median follow-up 71.8 months (36–93)		
	All patients (<i>n</i> = 187)	Long BP-limb (<i>n</i> = 87)	Long A-limb (<i>n</i> = 86)	<i>p</i> Value
Albumin	7 (3.7 %)	23 (26.4 %)	18 (20.9 %)	0.394
Vitamin B-12	12 (6.4 %)	24 (26.4 %)	16 (18.6 %)	0.161
Vitamin D	57 (30.5 %)	39 (44.8 %)	18 (20.9 %)	<0.001
PTH	1 (0.5 %)	15 (17.2 %)	3 (3.5 %)	0.003
Iron	2 (6.4 %)	32 (36.8 %)	13 (15.1 %)	<0.001
Ferritin	11 (5.9 %)	58 (66.7 %)	45 (52.3 %)	0.055
Haemoglobin	2 (1.1 %)	53 (60.9 %)	37 (43.0 %)	0.019
Iron and ferritin	0 (0 %)	20 (23.0 %)	12 (14.0 %)	0.126
Iron and ferritin and haemoglobin	0 (0 %)	15 (17.2 %)	10 (11.6 %)	0.185

Values given are number of patients and %; *p* values indicate difference in prevalence between the two arms of the study; $p < 0.05$ is taken to indicate statistical significance

3. Modification of the biliopancreatic limb in RYGB

RCT #2: Long vs. Short

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- Higher prevalence of vitamine deficiencies with long BPL
- Total bowel length not measured

Nergaard & Gislason, *Obes Surg* 2014

3. Modification of the biliopancreatic limb in RYGB

Dutch registry trial

PS matching

- Age
- BMI
- Sex
- ASA-score
- Comorbidities

Table 2 Primary and secondary outcomes for long and short BPL at 5 years in matched patients

Weight loss outcomes	Weight loss at 5 years		OR (95% CI)	β (95% CI)	P-value
	N= 2,528				
		Short BPL (< 100 cm) N= 1,264	Long BPL ($\geq$ 100 cm) N= 1,264		
$\geq 25\%$ TWL (yes/no, %)		63.9	67.9	1.19 (1.01 – 1.41)	0.04
%TWL (%)		28.4	29.7		1.26 (0.53 – 1.99) <0.001
%EWL (%)		69.9	73.2		3.29 (1.45 – 5.13) <0.001
Δ BMI (kg/m ²)		12.5	13.1		0.55 (0.19 – 0.91) 0.003
Comorbidity	Improvement at 5 years (%)				
	n	Short BPL (< 100 cm)	Long BPL ($\geq$ 100 cm)		
<i>Diabetes mellitus</i>	659	81.8	90.4	2.17 (1.31 – 3.60)	0.002
<i>Hypertension</i>	1,059	72.5	79.3	1.45 (1.06 – 1.99)	0.02
<i>Dyslipidemia</i>	578	73.6	74.2	1.02 (0.66 – 1.56)	0.94
<i>OSAS</i>	423	85.4	92.1	2.00 (0.94 – 4.26)	0.07
<i>GERD</i>	315	90.0	78.6	0.37 (0.13 – 1.12)	0.08
<i>Musculoskeletal pain</i>	1,425	60.3	58.1	0.92 (0.66 – 1.27)	0.60

Bruinsma, Nienhujs, Liem, Greve et al, *Obes Surg* 2024

3. Modification of the biliopancreatic limb in RYGB

Dutch registry trial (n > 5000)

PS matching

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- BMI
- Sex
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Bruinsma, Nienhujs, Liem, Greve et al, Obes Surg 2024

3. Modification of the biliopancreatic limb in RYGB

Dutch registry trial

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Statistically significant, but clinically relevant?

Bruinsma, Nienhujs, Liem, Greve et al, Obes Surg 2024

3. Modification of the biliopancreatic limb in RYGB

Dutch registry trial

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Long BPL with better metabolic outcome *Leve et al, Obes Surg 2024*

3. Modification of the biliopancreatic limb in RYGB

Dutch registry trial

Table 2 Primary and secondary outcomes for long and short BPL at 5 years in matched patients

Weight loss outcomes	Weight loss at 5 years N= 2,528	Short BPL (< 100 cm) N= 1,264	Long BPL (≥ 100 cm) N= 1,264	OR (95% CI)	β (95% CI)	P-value
≥ 25% TWL (yes/ no, %)		63.9	67.9	1.19 (1.01 – 1.41)		0.04
%TWL (%)		28.4	29.7		1.26 (0.53 – 1.99)	<0.001
%EWL (%)		69.9	73.2		3.29 (1.45 – 5.13)	<0.001
Δ BMI (kg/m ²)		12.5	13.1		0.55 (0.19 – 0.91)	0.003
Comorbidity	Improvement at 5 years (%)					
	n	Short BPL (< 100 cm)	Long BPL (≥ 100 cm)			
Diabetes mellitus	659	81.8	90.4	2.17 (1.31 – 3.60)		0.002
						0.02
						0.94
						0.07
						0.08
						0.60

PS matching

- Age
- BMI
- Sex
- ASA-score
- Comorbidity

1. total bowel length not measured
2. Nutritional deficiencies not reported

Bruinsma, Nienhujs, Liem, Greve et al, Obes Surg 2024

Evidence Summary of available evidence

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✓ **Lengthening the alimentary limb (AL)** improves weight loss outcomes, but increases the risk of malabsorption and long-term nutritional complications

Evidence Summary of available evidence

- ✓ **Lengthening the alimentary limb (AL)** improves weight loss outcomes, but increases the risk of malabsorption and long-term nutritional complications
- ✓ **Shortening the common limb (CL)** may enhance metabolic effects, but is associated with higher rates of protein-calorie malnutrition and micronutrient deficiencies

Evidence Summary of available evidence

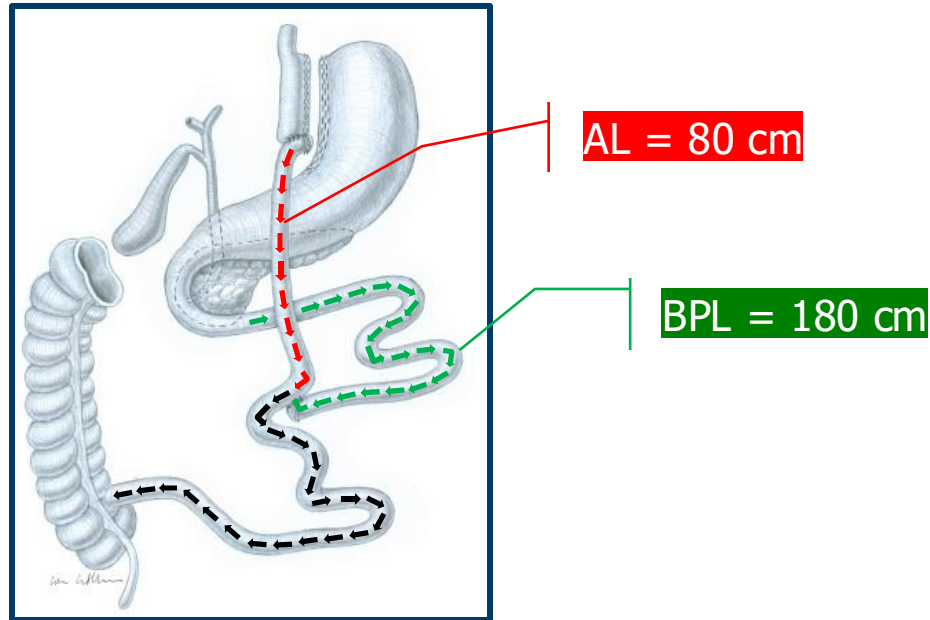
- ✓ **Lengthening the alimentary limb (AL)** improves weight loss outcomes, but increases the risk of malabsorption and long-term nutritional complications
- ✓ **Shortening the common limb (CL)** may enhance metabolic effects, but is associated with higher rates of protein-calorie malnutrition and micronutrient deficiencies
- ✓ **Lengthening the biliopancreatic limb (BPL)** appears promising for improving weight loss and metabolic outcomes, but existing evidence remains inconsistent

Open questions

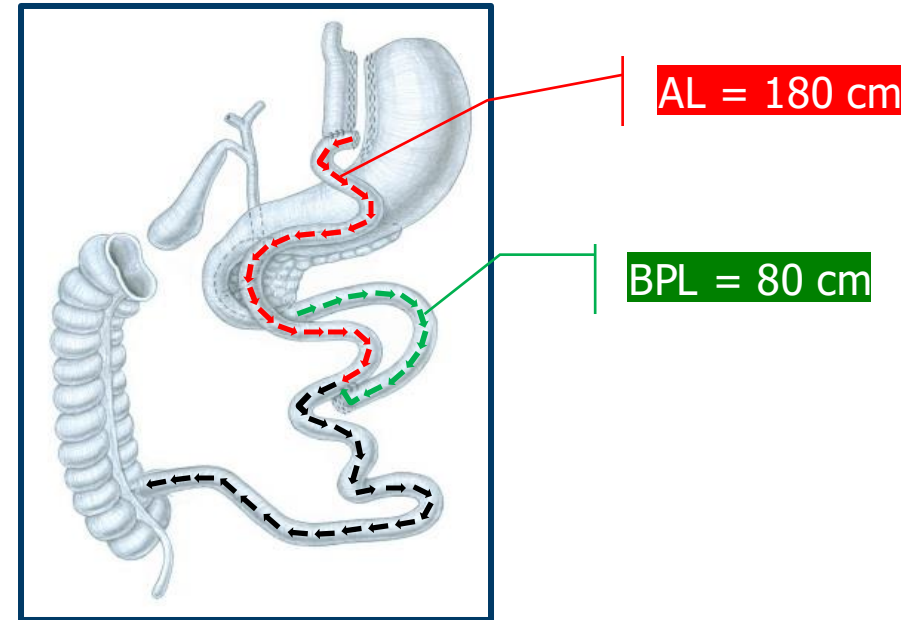
- ✓ What is the optimal balance between AL, BPL and CL?
- ✓ Should limb lengths be tailored to total bowel length?
- ✓ Can a longer BPL improve efficacy without increasing nutritional deficiencies?
- ✓ Is a “one-size-fits-all” approach appropriate?

Swiss Multicenter RCT on Different Limb Lengths in Gastric Bypass Surgery (SLIM)

Long BPL RYGB



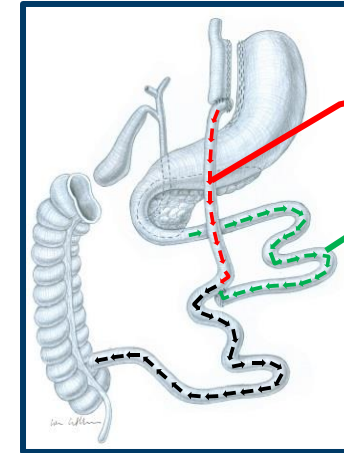
Short BPL RYGB



Swiss Multicenter RCT on Different Limb Lengths in Gastric Bypass Surgery (SLIM)

- RCT
 - 15 Swiss centers & Turku University, Finland
 - N = 800
 - Double blinded (patient & observer)
 - Total bowel length measured
 - Recruitment of main trial closed: Jan.15, 2024
- Outcomes:
 - Composite primary outcome:
 - % weight loss (superiority) & deficiency rate (non-inferiority) at 5 y
 - Secondary outcomes:
 - Effectivity (Remission of comorbidities, QoL)
 - Safety
 - Influence of pouch size on dumping
 - Influence of all limbs on all outcomes in subgroup analysis

Long BPL RYGB

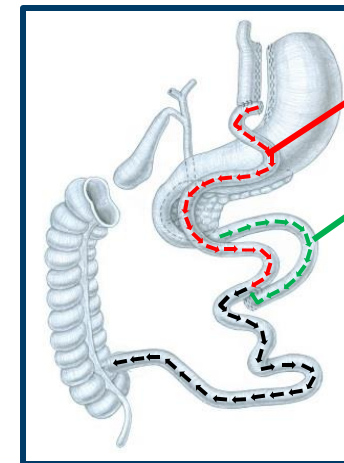


AL = 80 cm

BPL = 180 cm

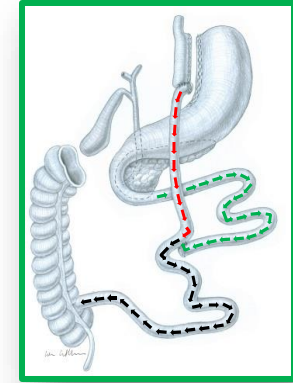
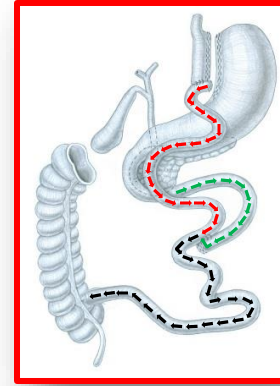
mean CL = CL

Short BPL RYGB



AL = 180 cm

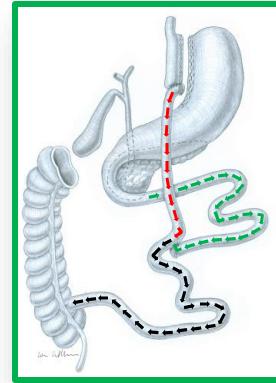
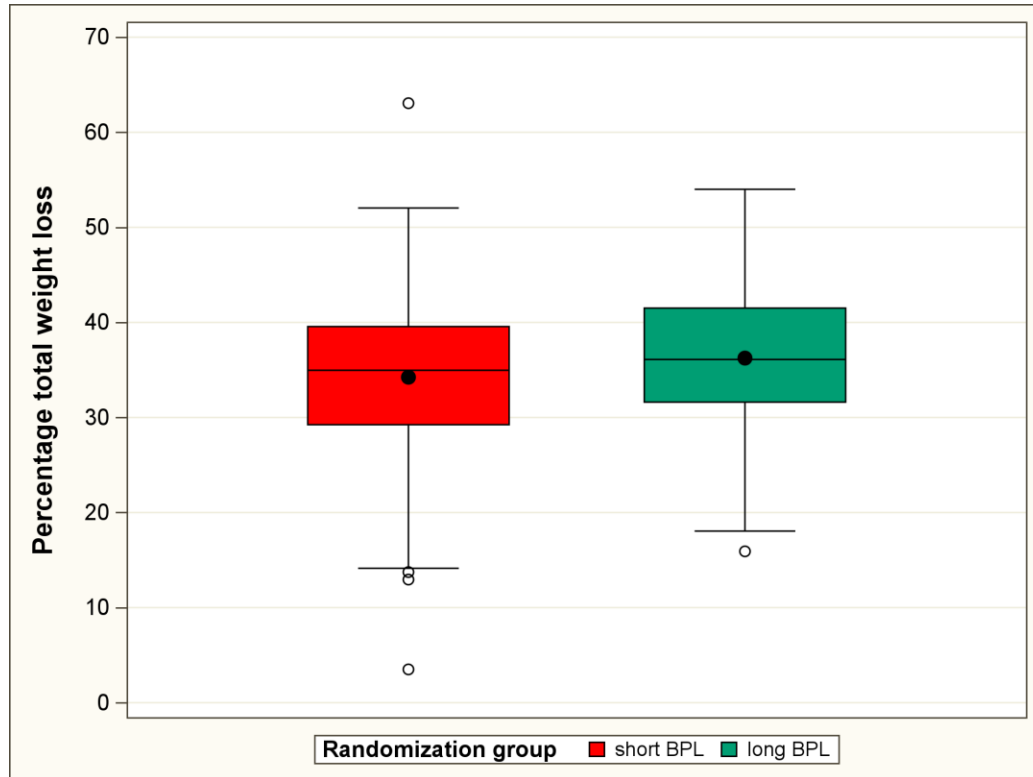
BPL = 80 cm



Bowel segments (cm)	Short BPL (n=397)	Long BPL (n=375)
Total small bowel length	656 ± 100	664 ± 104
AL	180	80
BPL	80	180
CL	396 ± 100	404 ± 104

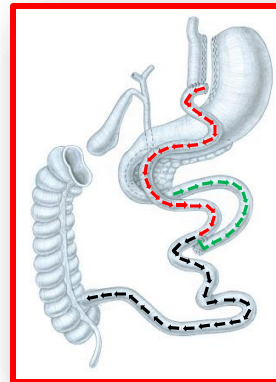
SLIM Trial 1 Year Results Weight Loss

- % WL between groups



Long BPL RYGB

36.2 %
(35.5, 37.0)



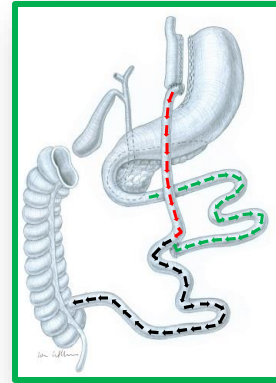
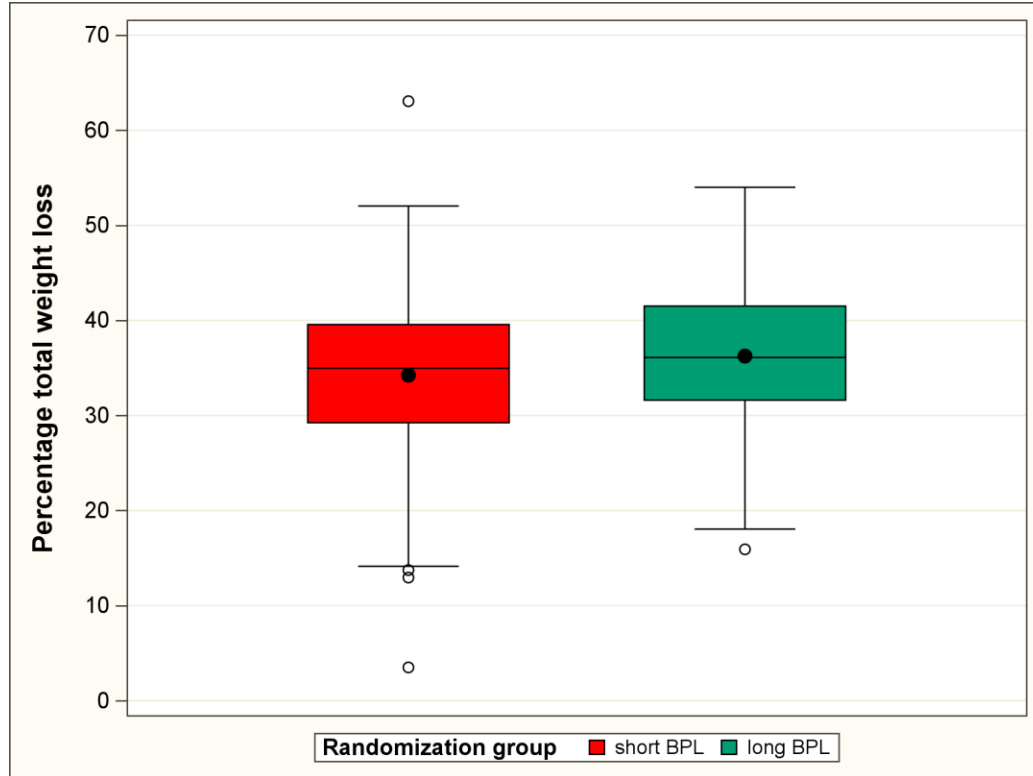
Short BPL RYGB

34.2 %
(33.5, 35.0)

$p < 0.0001$

SLIM Trial 1 Year Results Weight Loss

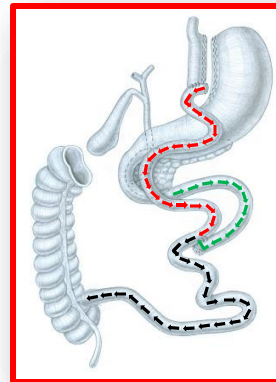
- % WL between groups



Long BPL RYGB

36.2 %
(35.5, 37.0)

35.1 %
(34.0, 36.3)



Short BPL RYGB

34.2 %
(33.5, 35.0)

32.9 %
(31.7, 34.1)

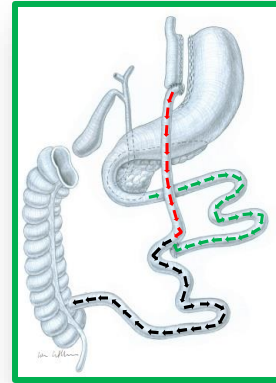
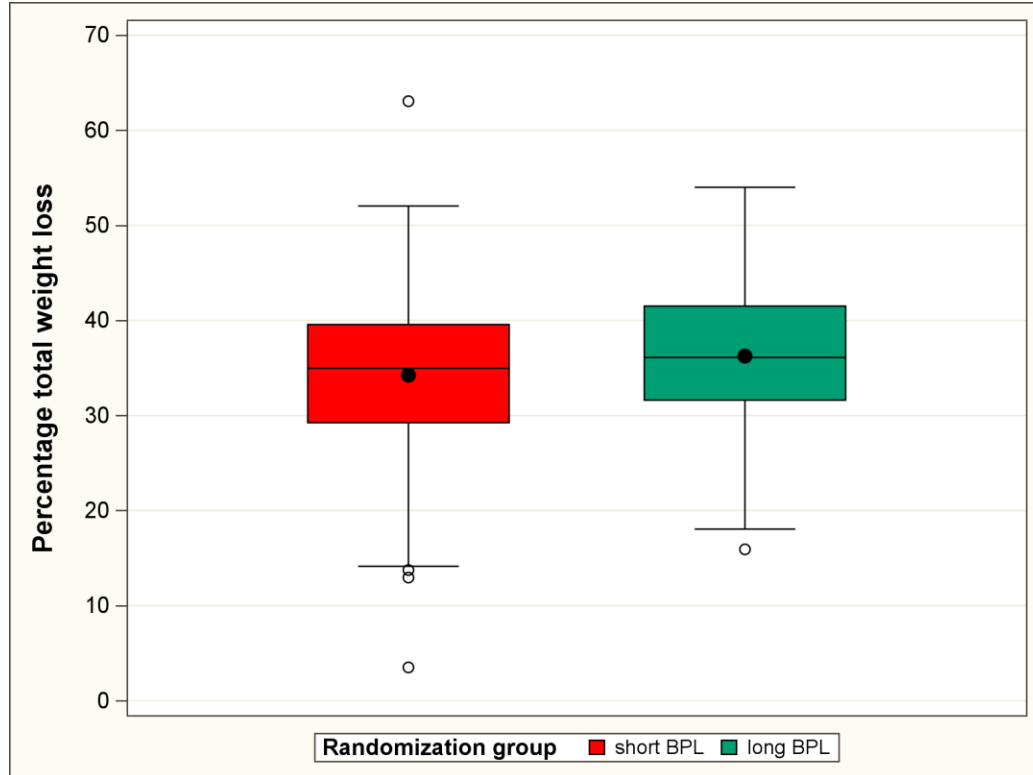
$p < 0.0001$

$p < 0.0001$

SLIM Trial 1 Year Results Weight Loss

- % WL between groups

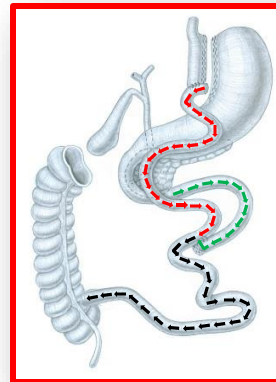
%WL < 20%



Long BPL RYGB

n = 5

36.2 %
(35.5, 37.0)



Short BPL RYGB

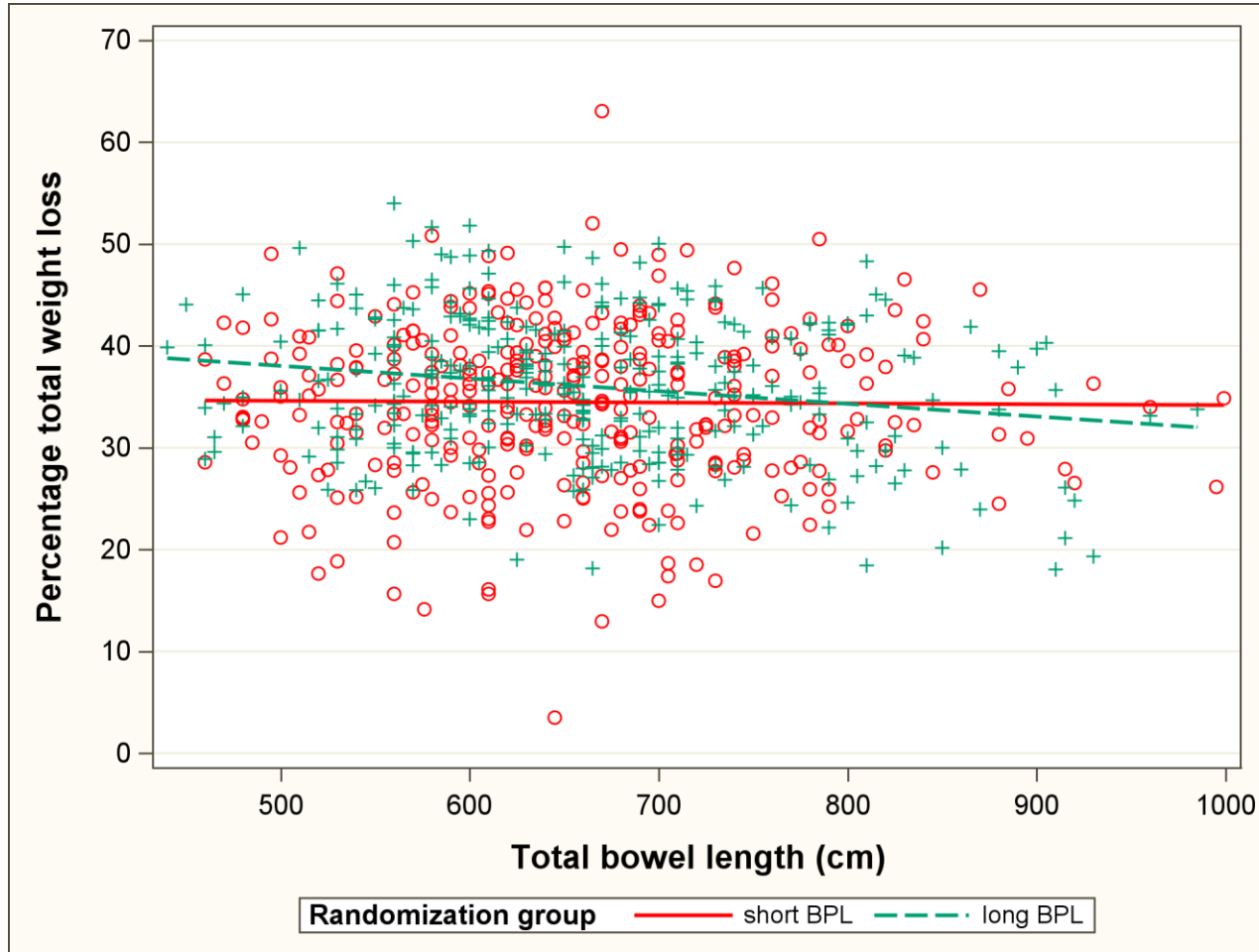
n = 5

34.2 %
(33.5, 35.0)

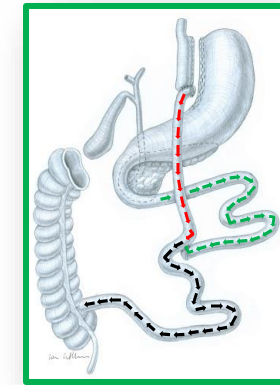
$p < 0.0001$

SLIM Trial 1 Year Results *Effect of Total Bowel Length on %WL*

- % WL

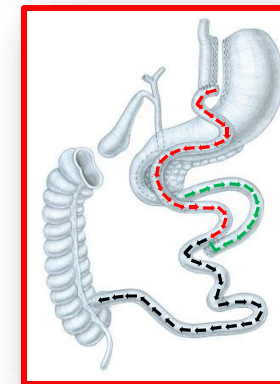


Long BPL



Shorter TBL
→
better weight loss

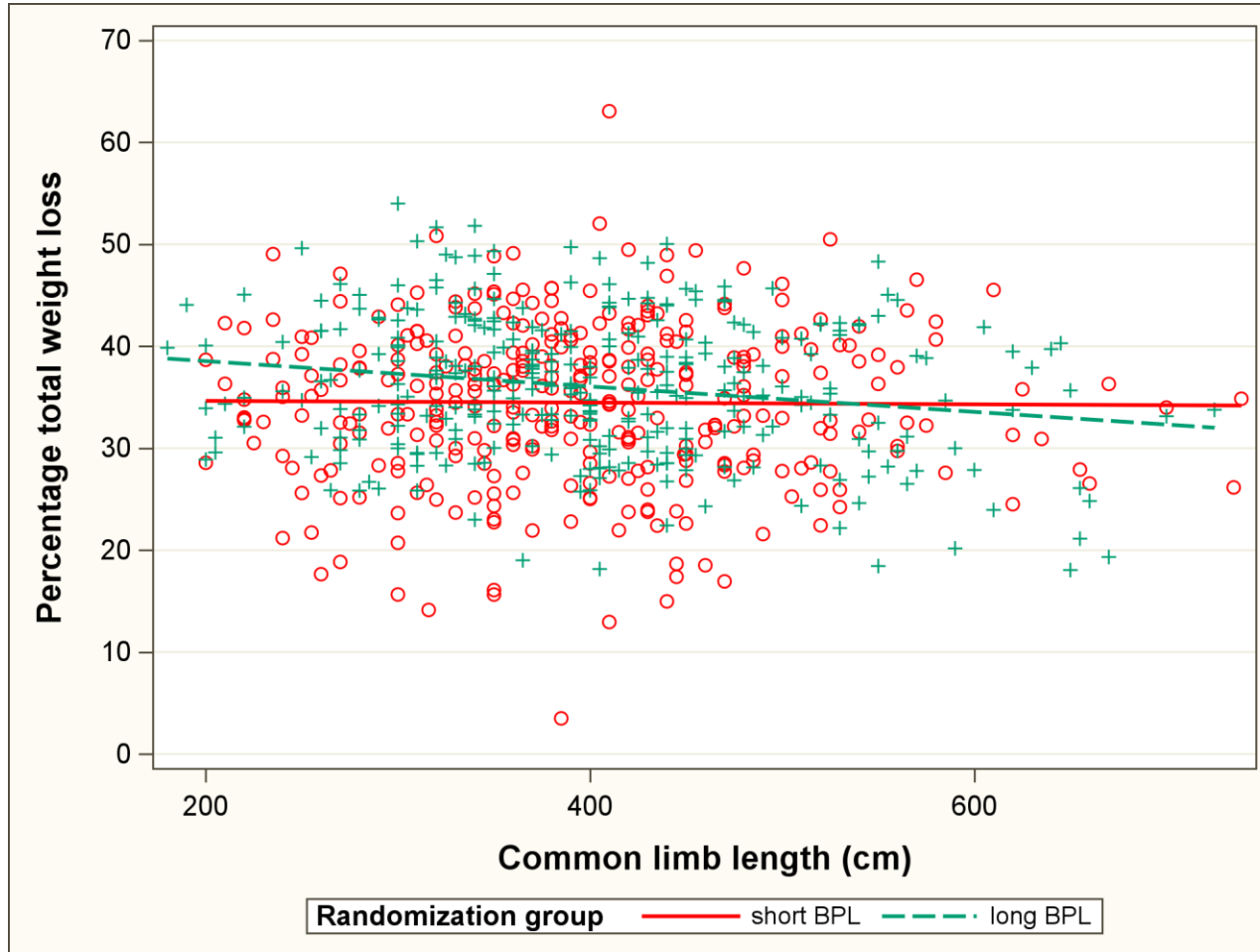
short BPL



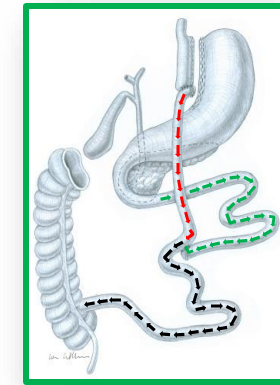
TBL
no effect
on weight loss

SLIM Trial 1 Year Results *Effect of Common Limb on %WL*

- % WL

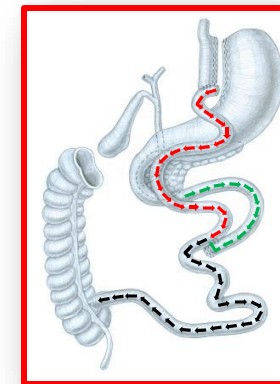


Long BPL



Shorter CL
→
better weight loss

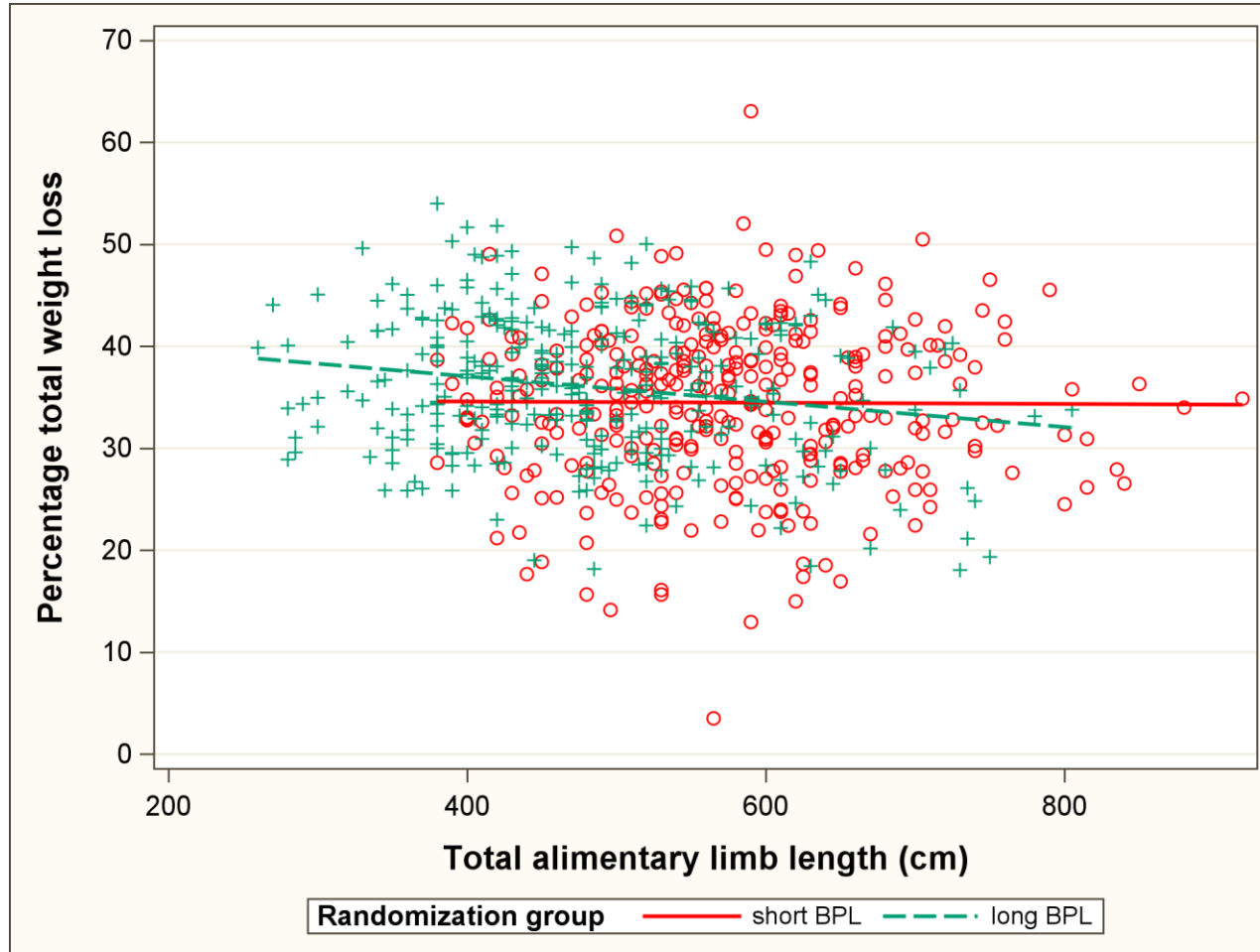
short BPL



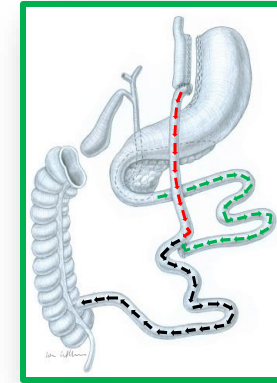
CL
no effect
on weight loss

SLIM Trial 1 Year Results Effect of **TAL** on %WL

- % WL

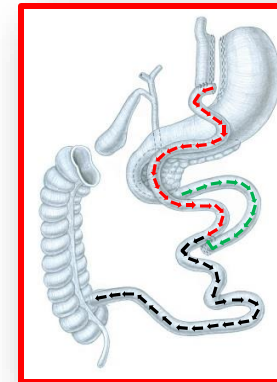


Long BPL

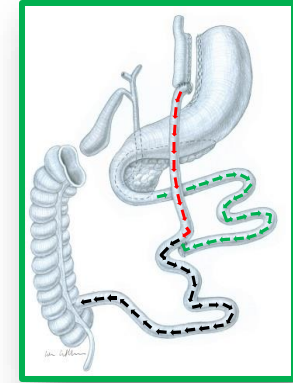
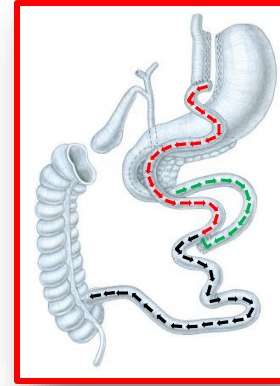


Shorter **TAL**
→
better weight loss

short BPL



TAL
no effect
on weight loss



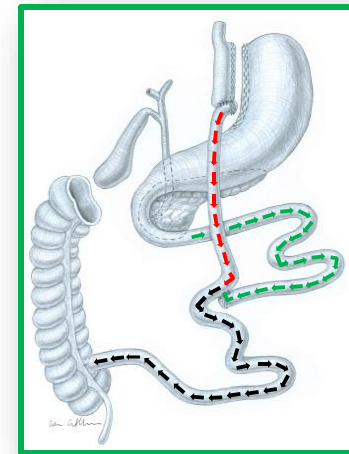
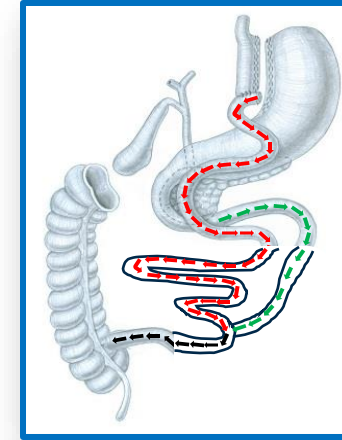
Complications Clavien-Dindo (n, %)	Short BPL (n=397)	Long BPL (n=375)
• IIIa	1 (0.25)	6 (1.6)
• IIIb	7 (1.8)	8 (2.1)
• IV	2 (0.5)	2 (0.5)
• V	0	0

SUMMARY

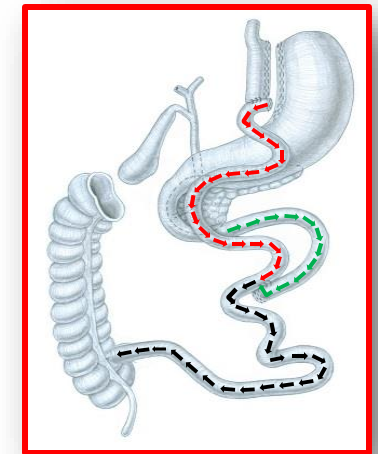
What do we *not* know in Roux-en-Y Gastric Bypass ?

Ideal limb lengths:

- Total small bowel length varies
 - SLIM trial: 653 ± 113 cm (min 300 cm, max 1050 cm)
- Very long **AL** and very short CL = dangerous
- Longer **BPL** may lead to:
 - Improved weight loss
 - Better metabolic effect (T2DM, dyslipidemia) ?
 - BUT: more deficiencies ?



VS





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	Short BPL (n=397)	Long BPL (n=375)
Female (%)	74	70
Age (y)	41.4 ± 11.6	41.3 ± 10.5
Weight	120.3 ± 20.0	119.5 ± 18.2
BMI (kg/m ²)	42.7 ± 5.1	42.3 ± 5.0
Waist circumference (cm)	123.3 ± 15.4	123.8 ± 14.5
T2 Diabetes (n, %)	57 (14.4)	77 (22.8)
• Insulin dependent	(3.6)	(3.9)
Dyslipidemia	228 (58.3)	224 (58.8)
Hypertension	168 (42.2)	153 (39.9)
OSAS	145 (37.0)	142 (37.3)
GERD	178 (44.9)	173 (45.2)

SLIM Trial

Intraoperative Parameters

- Total bowel length measurement
 - Technique:
 - Measure band: 30%
 - Marked forceps 10cm: 10%
 - Marked forceps 5cm: 60%
 - Duration: <14 min
 - Associated complications: 19/779 (2.4%)
 - 2 perforations, 17 serosal lesions
 - 12/19 (63.2%) with measure band!
 - Complete measurement:
 - Complete: 93.4%
 - Incomplete: 6.6%
 - Total small bowel length (including pts with too short bowel): 659 ± 113 cm
 - Min 300 cm
 - Max 1050 cm

