Clarunis
University Digestive Health Care Center
St. Clara Hospital and University Hospital Basel

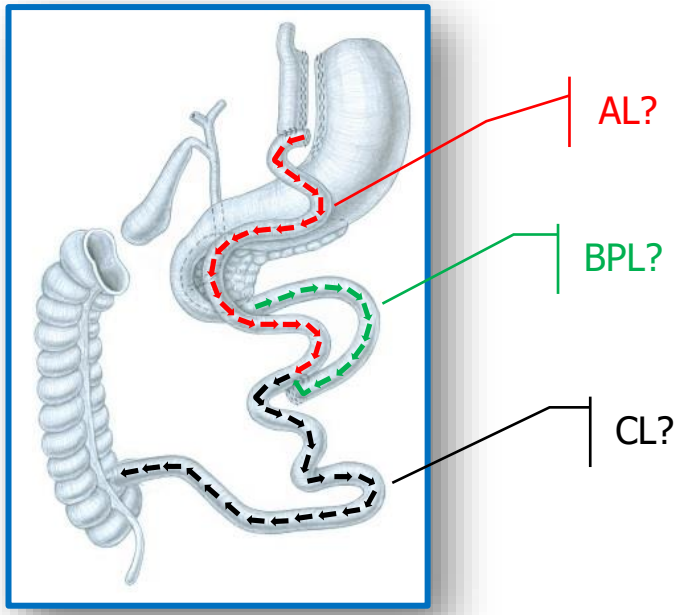
IFSO MELBOURNE 2024

Claraspital

University Hospital Basel

University of Basel

Evidence Based Medicine for limb lengths in bypass surgery: Is there optimal BP-limb length? Standard limb lengths or a tailored approach?



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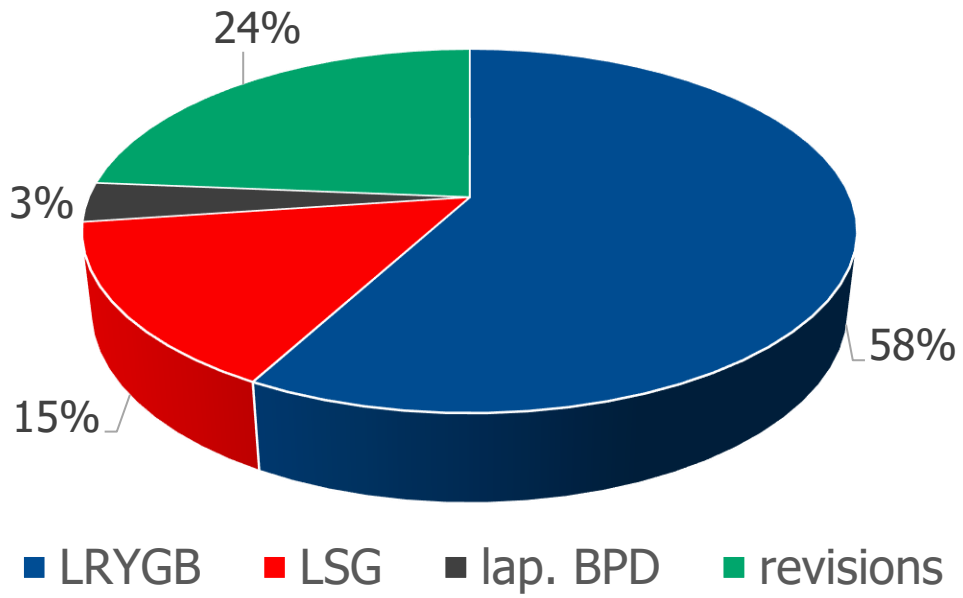
Clarunis: University Digestive Health Care Center, St. Clara Hospital and University Hospital Basel, Switzerland

Disclosure

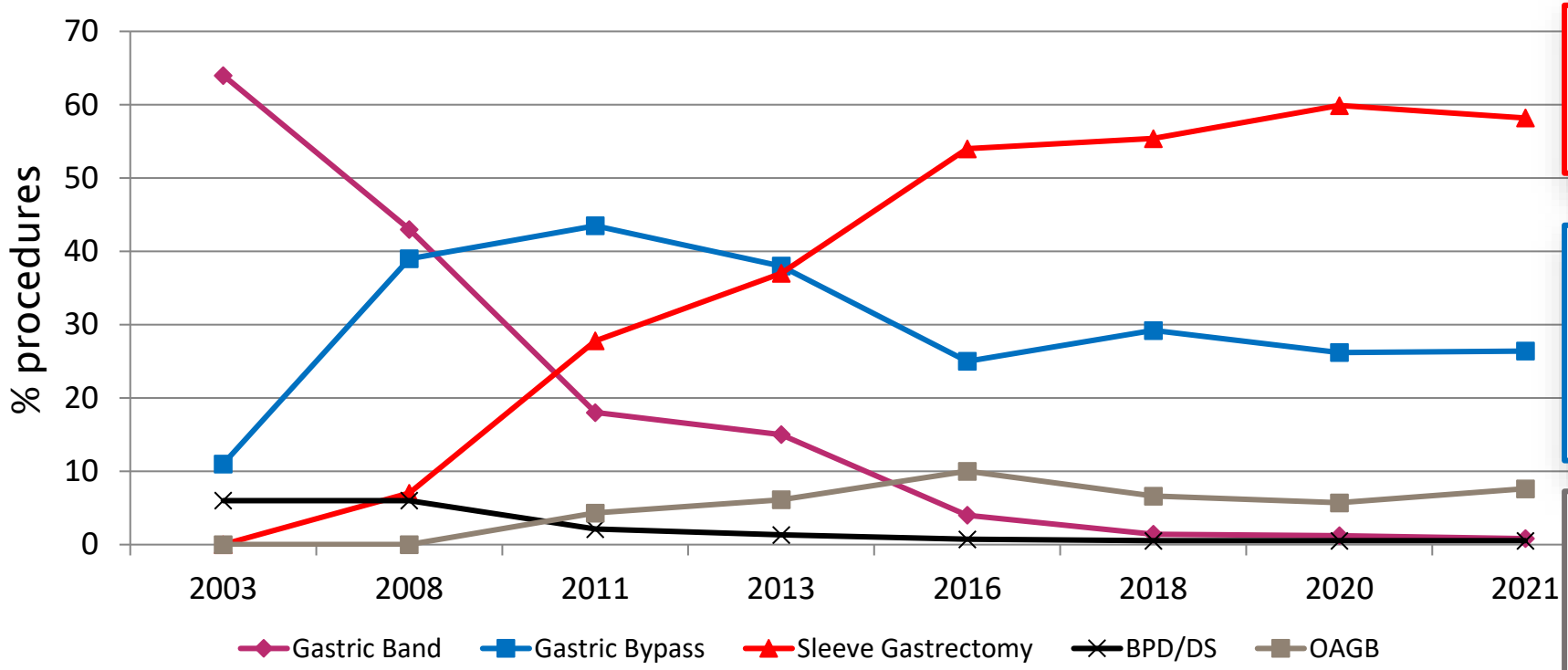
- Research grants: Swiss National Science Foundation, J&J, Hirzbrunnen Foundation NovoNordisk, UKBB, Novartis
- Lecture/consulting fees: Ethicon Endosurgery, Viatris, Falk Foundation, NovoNordisk, Lilly
- Case mix disclosure

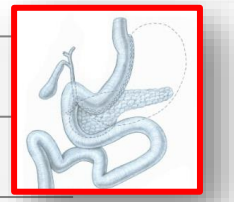


OAGB, SADI: 0%

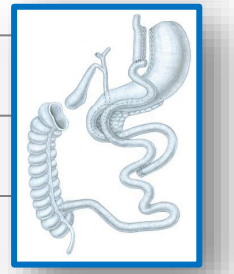
BACKGROUND

Procedures worldwide ~ 10^6

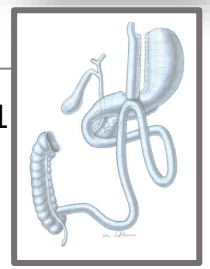




70% 43% 23%



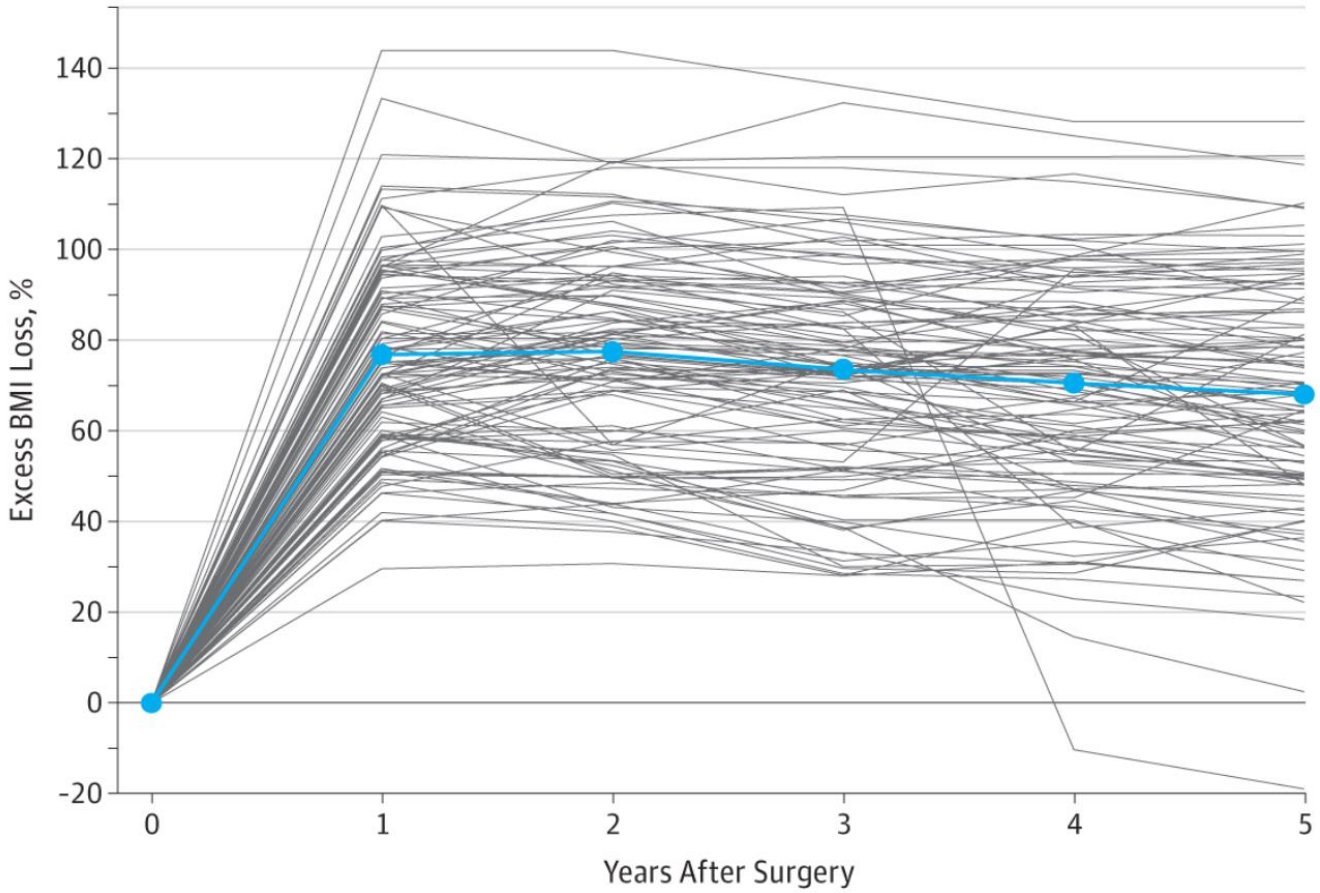
27% 29% 75%

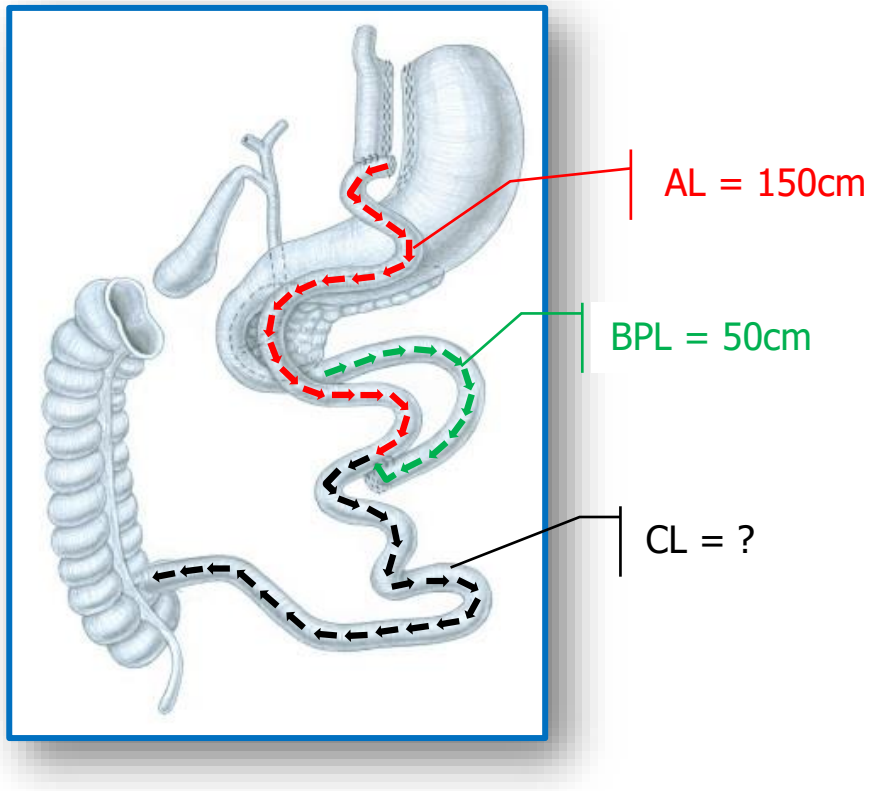


0.5% 16% 1%

Variety of weight loss results *in highly standardized Gastric Bypass*

- SM-BOSS → Sleeve vs Gastric Bypass (110 vs 107 patients)

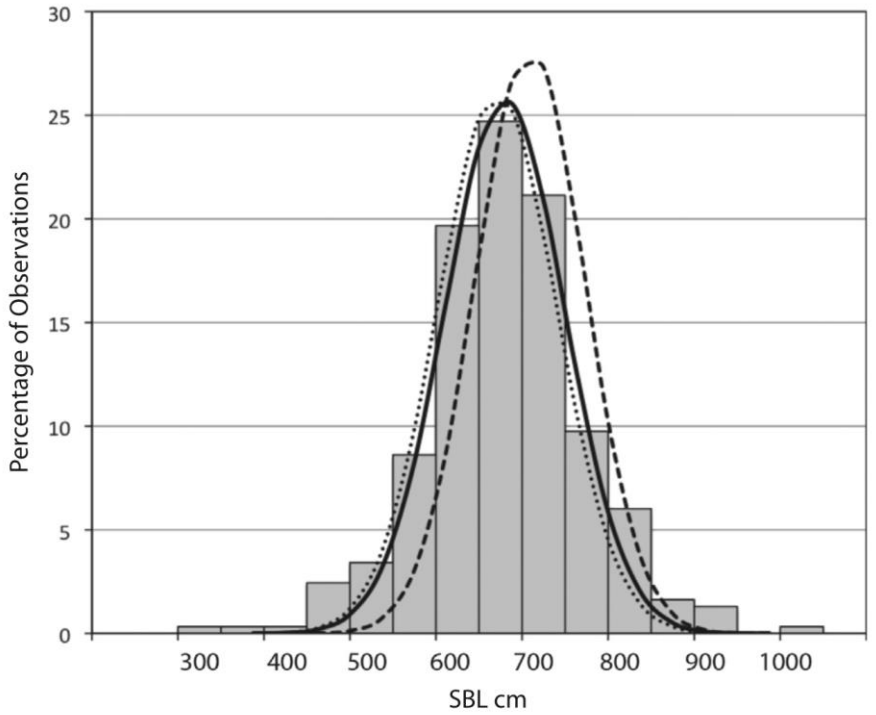




Variety of Total Small Bowel Length

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

- Personal experience
  - Open BPD-DS (10cm with ruler)
    - N=120
    - 600cm (350 – 1300cm)
  - LRYGB, LBPD-DS etc.
    - Laparoscopy: 5cm steps
      = best reproducability



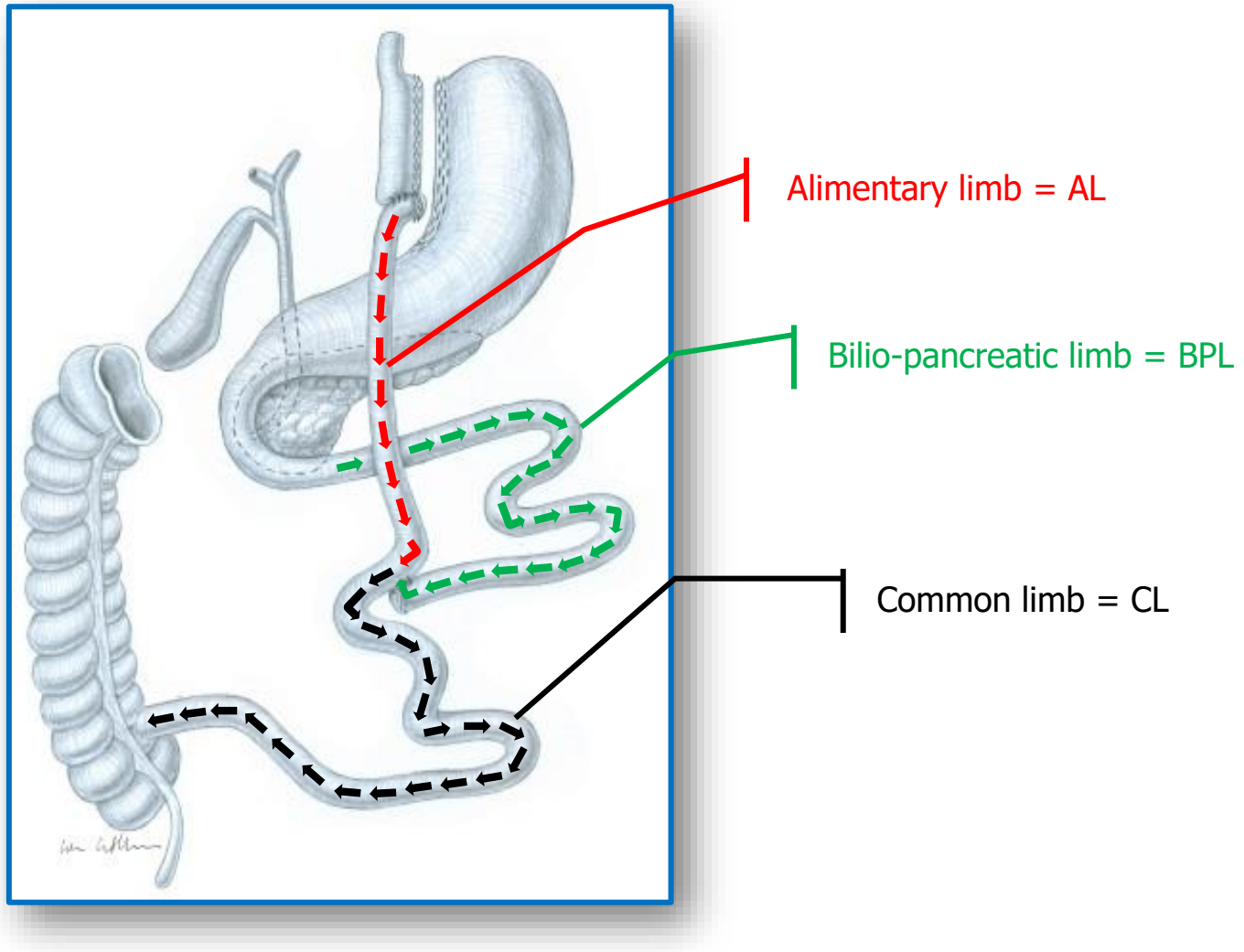
Possibilities of changing the different limb lengths in RYGB

- Lengthening of alimentary limb (AL)
- Lengthening of bilio-pancreatic limb (BPL)
- Shortening of common limb (CL)

- Combinations of two changes

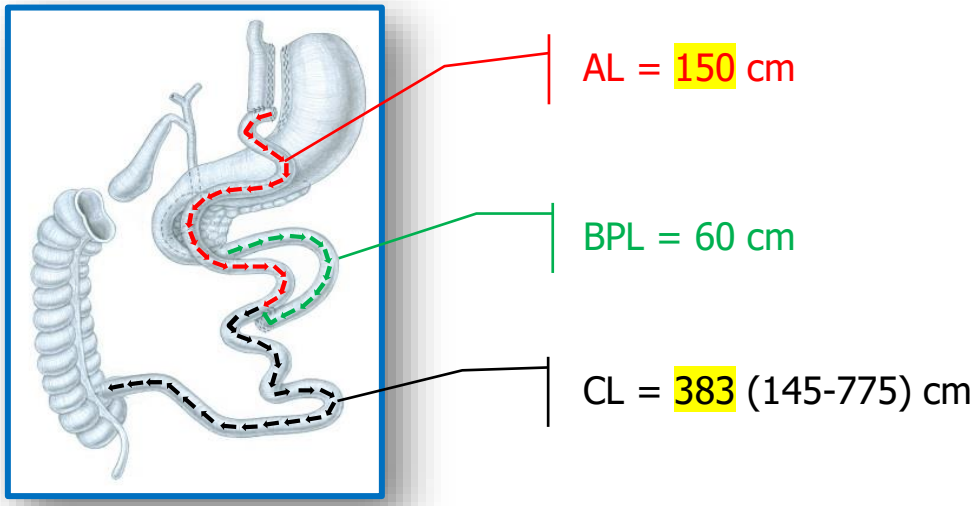
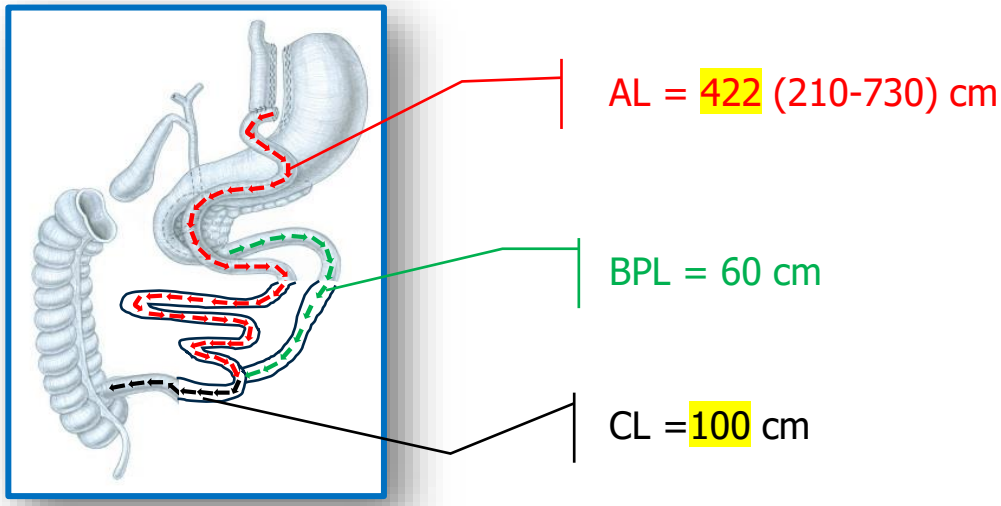
- The length of one limb:
  - Influences the length of the other(s)
  - Its effect cannot be analysed without knowledge of the other two

  - Consequence: Total bowel length has to be known



Increasing the length of the alimentary limb (AL) in RYGB

DUCATI Trial: RCT, N=444

	Standard-LRYGB	VLRL-LRYGB
	 AL = 150 cm; BPL = 60 cm; CL = 383 (145-775) cm	 AL = 422 (210-730) cm; BPL = 60 cm; CL =100 cm
• % EWL 3y	77%	85% *(p=0.04)*
• T2DM remission	72%	49% *(p=0.04)*
• Complications	9%	9%
– Malabsorption	0.9%	3.6% *(p=0.056)*

➡ bowel adjustment

- Conclusion: Lengthening of AL does (not) work
  Risk of liver damage ↑ *Moolenaar L, J Clin Gastroenterol 2022*

Evidence

Total alimentary limb (TAL = AL & CL)

- Metaanalysis
  - N = 21 trials (12 primary RYGB, 2 RCT)
  - >4760 pts
- Results:
  - Better weight loss if TAL leads to longer BPL
  - Shorter CL: more deficiencies
- Conclusion:
  In primary RYGB:
  - TAL = 400cm and CL 200cm = safe & effective

  In revisional RYGB:
  - TAL may be shorter (min 300?)

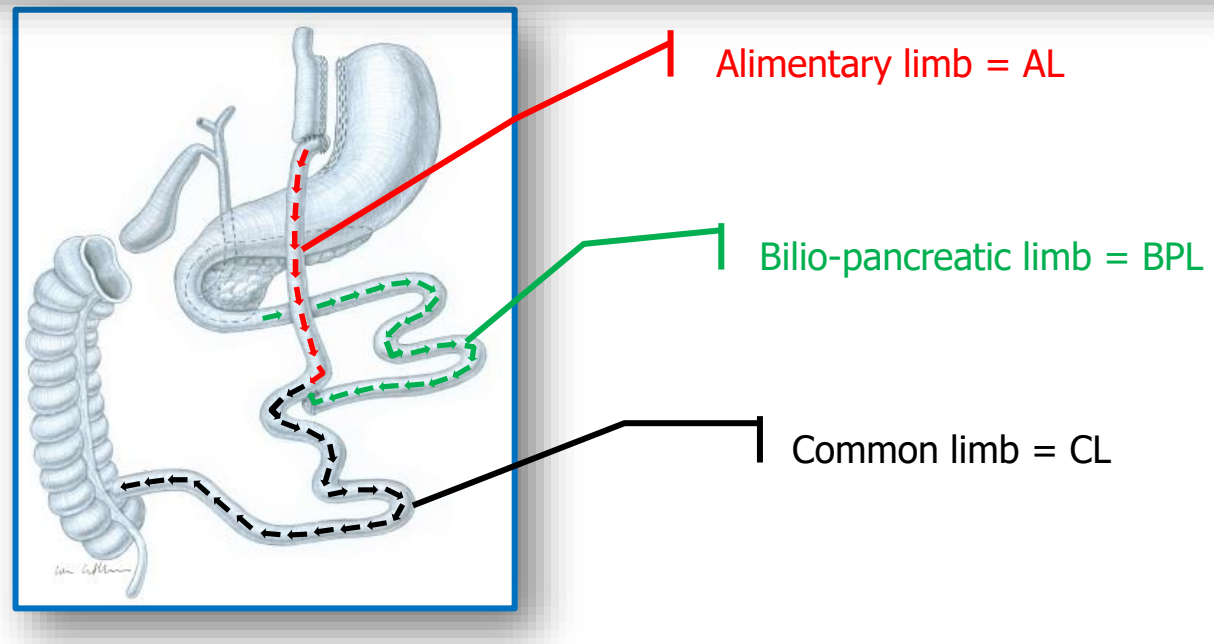
Surgery for Obesity and Related Diseases 18 (2022) 555–564

The role of total alimentary limb length in Roux-en-Y gastric bypass: a systematic review

Alice Wang, M.D., M.H.S.[a], Lauren Poliakin, M.D.[a], Naresh Sundaresan, M.D.[a], Vilok Vijayanagar, D.O.[b], Alexander Abdurakhmanov, M.D.[a], Kyle J. Thompson, Ph.D.[b], Iain H. Mckillop, Ph.D.[b], Selwan Barbat, M.D.[a], Roc Bauman, M.D.[a], Keith S. Gersin, M.D.[a], Timothy S. Kuwada, M.D.[a], Abdelrahman Nimeri, M.D., F.A.C.S., F.A.S.M.B.S.[a,*]

[a]*Atrium Health Weight Management, Section of Bariatric & Metabolic Surgery, Department of Surgery, Carolinas Medical Center, Atrium Health, Charlotte, North Carolina*

[b]*Division of Research, Department of Surgery, Carolinas Medical Center, Atrium Health, Charlotte, North Carolina*



Evidence

- Metaanalysis (N = 13 trials, 1934 pts)
- CL 75cm – 600cm

- Results:
  - △ 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

Changing Common limb length

REVIEW ARTICLE

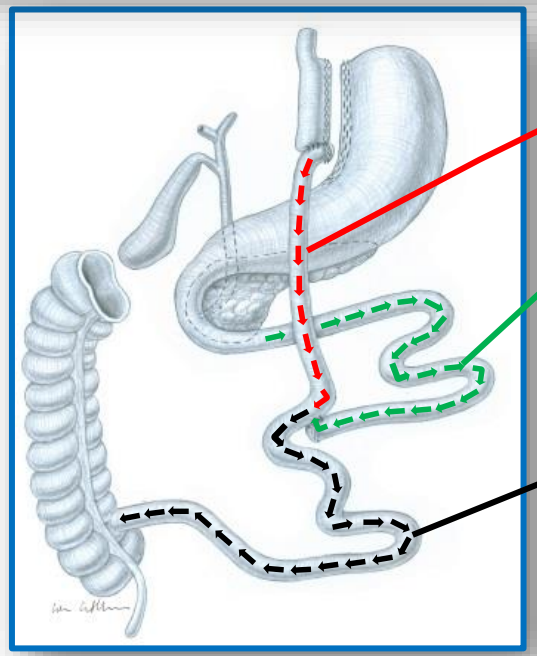
Royal Australasian College of Surgeons

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,*† Qiuye 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



Alimentary limb = AL

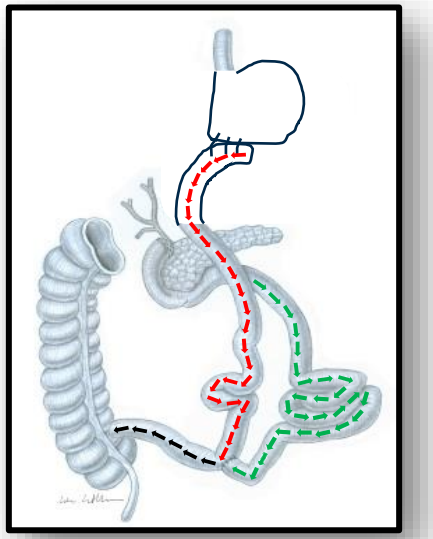
Bilio-pancreatic limb = BPL

Common limb = CL

Increasing the BPL

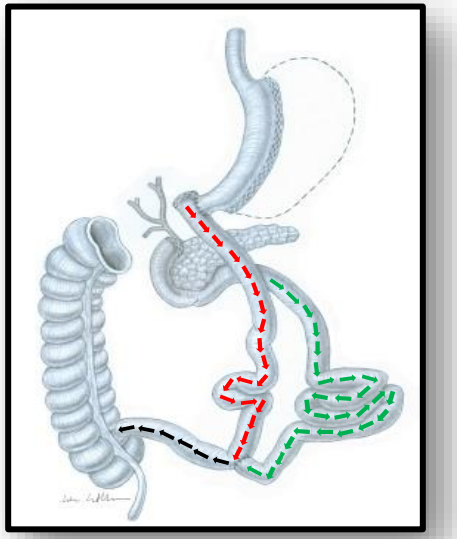
Bilio-pancreatic Diversion

- Maximum weight loss (78% excess BMI loss >10 y) *
- Highest rate of diabetes remission (95%) *



Scopinaro
- BPL = TBL – AL (250cm)
- CL: 50-75cm

Scopinaro, Obes Surg & WJS 1991-2017



Marceau
- BPL = TBL – 250cm (age>50: 350)
- CL: 100cm

Marceau, Obes Surg 1995-2015, Peterli Obes Surg 2007

Hess
- BPL = 50% TBL
- AL = 40%; CL 10% (75-100cm)

Hess Obes Surg 2005

RCT #1: Long BPL vs Short BPL

Elegance Trial

- BMI 43 / 45
- FU 91% at 4y

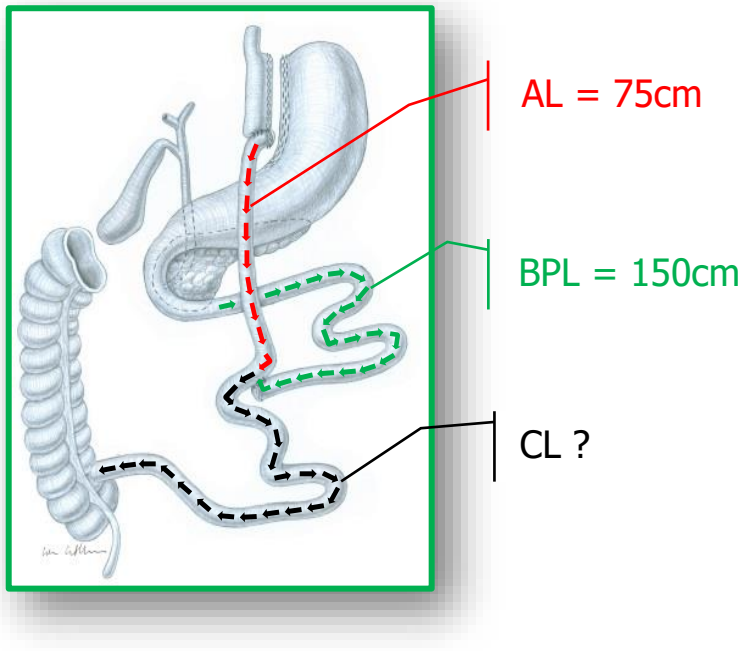
- %EWL:
  - 1y 81 / 71 (p=0.007)
  - 4y 72 / 64 (p<0.05)

- %TWL (=primary endpoint)
  - 1y 33 / 31 (p=0.042)
  - 4y 30 / 27 (p=0.15)

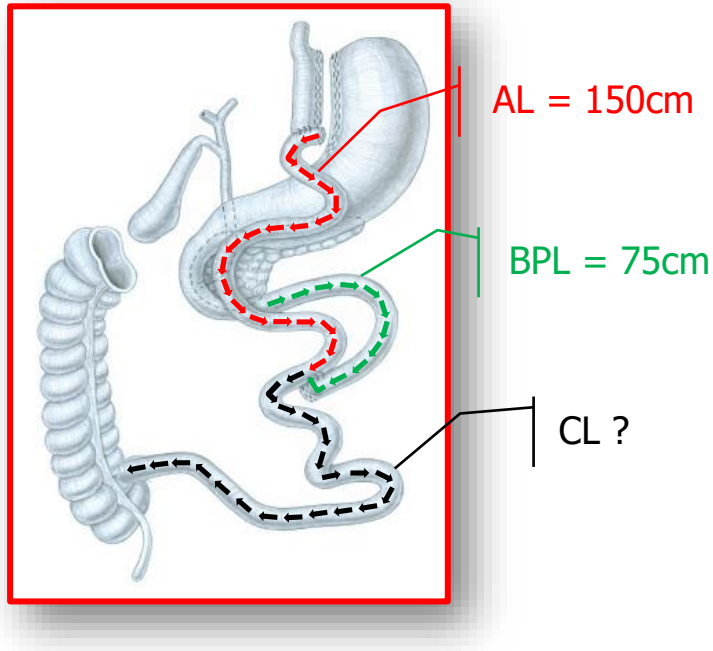
- Co-morbidities
  - T2DM, HAT no difference
  - Dyslipidemia: 95 / 83 % (p=0.02)

- Complications
  - early: 10 / 5 % (n.s.)
  - late: 28 / 30 % (deficiencies not mentioned!)

Long BPL: n = 67

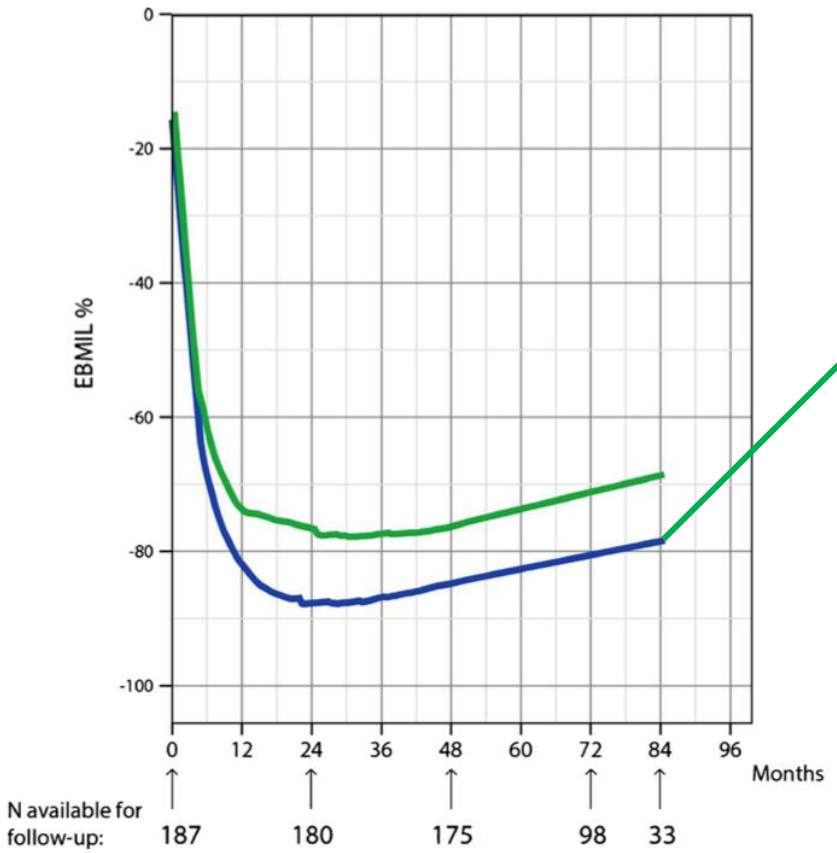


Short BPL: n = 74

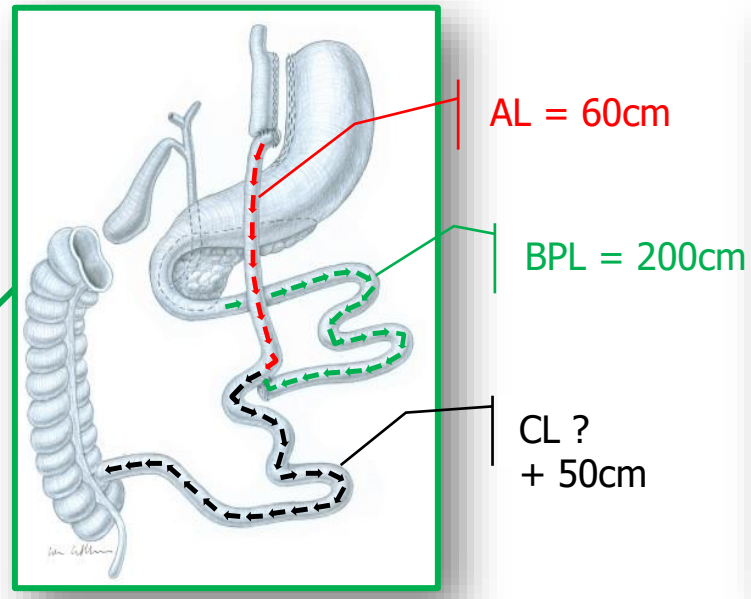


RCT #2: Long BPL vs Short BPL

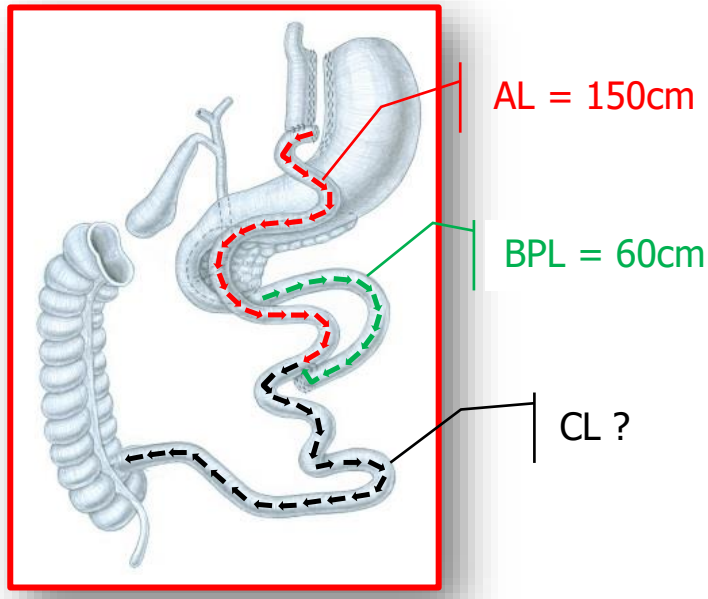
- BMI 44
- FU 85% at 5y



Long BPL: n = 94



Short BPL: n = 93



RCT #2: Long BPL vs Short BPL

- Co-morbidities: no difference
- Deficiencies:

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

	Before surgery	3 to 9 years after surgery ($n = 177$), median follow-up 71.8 months (36–93)		
	All patients ($n = 187$)	Long BP-limb ($n = 87$)	Long A-limb ($n = 86$)	p 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

Evidence

Modification of BPL in RYGB

- Metaanalysis

ELSEVIER

Surgery for Obesity and Related Diseases xxx (xxxx) xxx

SURGERY FOR OBESITY AND RELATED DISEASES

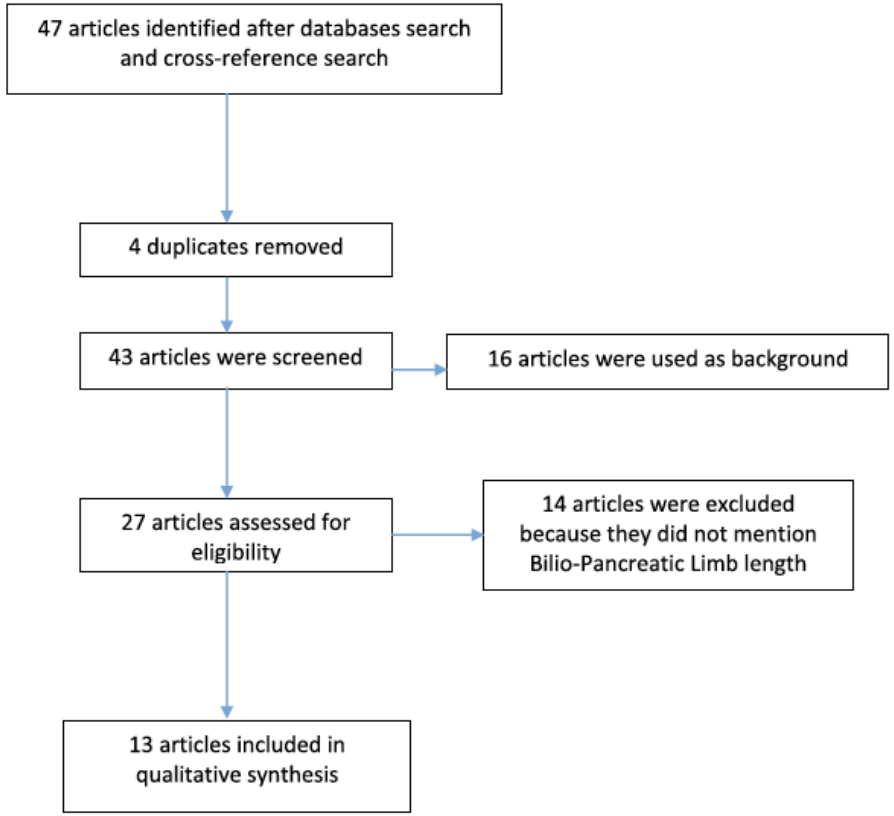
Original article

The importance of the biliopancreatic limb length in gastric bypass: A systematic review

Luis F. Zorrilla-Nunez, M.D., Anthony Campbell, M.S., Giulio Giambartolomei, M.D., Emanuele Lo Menzo, M.D., Ph.D., F.A.C.S., F.A.S.M.B.S., Samuel Szomstein, M.D., F.A.C.S., F.A.S.M.B.S., Raul J. Rosenthal, M.D., F.A.C.S., F.A.S.M.B.S.*

The Bariatric & Metabolic Institute, Section of Minimally Invasive Surgery, Cleveland Clinic Florida, Weston, Florida

Received 30 May 2018; received in revised form 26 September 2018; accepted 15 October 2018; Available online xxx



Evidence

Modification of BPL in RYGB

- Weight loss and diabetes remission

Authors	Weight Loss Short Limb	Weight Loss Long Limb	Diabetes Short Limb	Diabetes Long Limb	Follow-Up, mo
Brolin et al. [14]	BMI 63.4 to >43	BMI 61.6 to >37	43% resolved/47% improved	43% resolved/47% improved	48
Maclean et al. [15]	BMI 65.1 to >39.8	BMI 63.1 to >33–36	N/A	N/A	75
Feng et al. [16]	66.3% EWL	58.2% EWL	N/A	N/A	12
Inabnet et al. [17]	83% EWL	65% EWL	N/A	N/A	24
Leifsson and Gislason [18]	N/A	93% EWL	N/A	N/A	18
Pinheiro et al. [22]	70% EWL	74% EWL	98% improved	95.50% improved	48
Nora et al. [19]	N/A	69.6 EBMIL	N/A	92.6% resolved	12
K. Dogan	52.2% EWL	61.7% EWL	N/A	N/A	6
Nergaard et al. [20]	67.1% EBMIL	78.4% EBMIL	74% resolvedNo difference	74% resolvedNo difference	7 yr
Homan et al. [23]	33.3%–34.1% TWL	34% TWL	N/A	N/A	12
Kaska et al. [24]	Loss of BMI −27.7%	Loss of BMI −38.4%	74.5% Hb <6	95.2% Hb <6	24
Ramos et al. [25]	79.9 ± 19.4% EWL	77.9 ± 21.6% EWL	83% controlled	84% controlled	25
Guimarães et al. [21]	87.6 ± 1.21% EWL	90.7 ± 3.2% EWL	6.1 ± .1%	5.92 ± 0.2%	26

EBMIL = excess body mass index loss; EWL = excess weight loss; BMI = body mass index; TWL = total weight loss; Hb = hemoglobin A1C; N/A = not applicable.

Evidence

Modification of BPL in RYGB

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Guimarães et al. [21]	87.6 ± 1.21% EWL	90.7 ± 3.2% EWL	6.1 ± .1%	5.92 ± 0.2%	26

EBMIL = excess body mass index loss; EWL = excess weight loss; BMI = body mass index; TWL = total weight loss; Hb = hemoglobin A1C; N/A = not applicable.

No Trial measured total bowel length

Dutch registry Trial

Modification of BPL in RYGB

- N > 5000
- PS matching:
  - Age
  - BMI
  - Sex
  - ASA-score
  - Comorbidities

- Results 5y:

* 1y: GERD better with long AL

- No information on:
  - Nutritional issues

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
Hypertension	1,059	72.5	79.3	1.45 (1.06 – 1.99)		0.02
Dyslipidemia	578	73.6	74.2	1.02 (0.66 – 1.56)		0.94
OSAS	423	85.4	92.1	2.00 (0.94 – 4.26)		0.07
GERD	315	90.0	78.6	0.37 (0.13 – 1.12)		0.08
Musculoskeletal pain	1,425	60.3	58.1	0.92 (0.66 – 1.27)		0.60

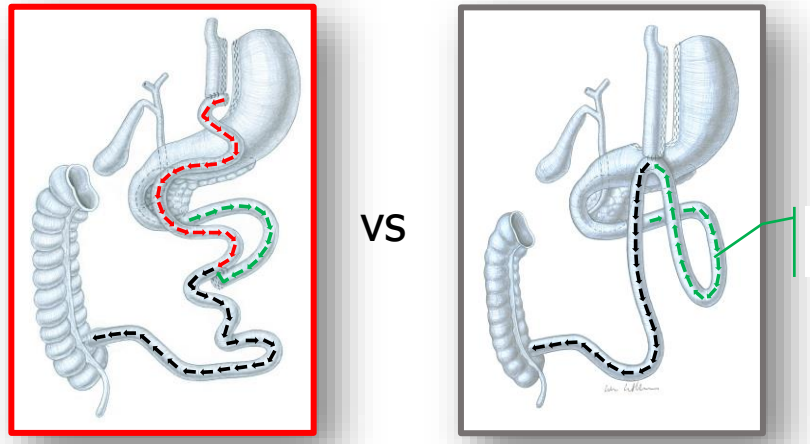
*

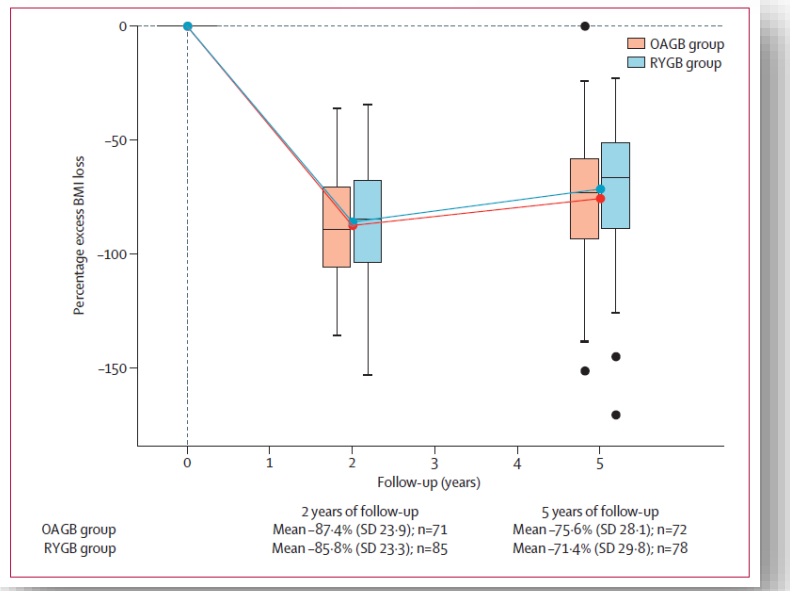
Bilio-pancreatic limb length in OAGB

Efficacy and safety of one anastomosis gastric bypass versus Roux-en-Y gastric bypass at 5 years (YOMEGA): a prospective, open-label, non-inferiority, randomised extension study

Maud Robert, Tigran Poghosyan, Delphine Maucort-Boulch, Alexandre Filippello, Robert Caiazzo, Adrien Sterkers, Lita Khamphommala, Fabian Reche, Vincent Malherbe, Adriana Torcivia, Toufic Saber, Dominique Delaunay, Carole Langlois-Jacques, Augustin Suffisseau, Sylvie Bin, Emmanuel Disse, François Pattou

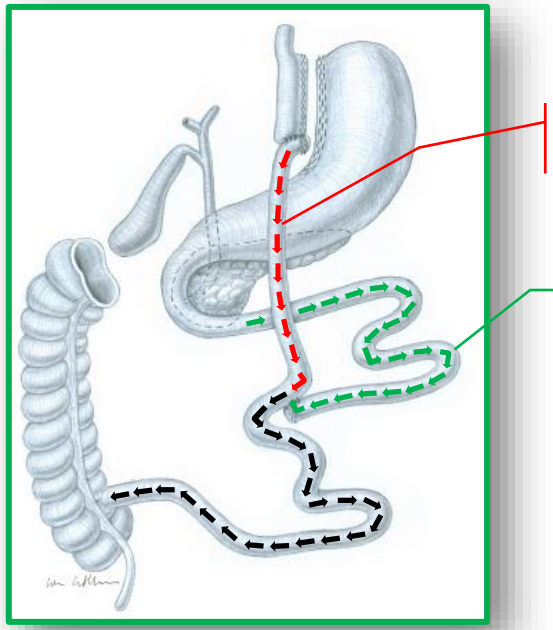
- Design:
  - Multicentre RCT, non inferiority
  - Primary endpoint: % excess BMI loss
  - 127 OAGB (200cm BPL) vs 121 RYGB (150cm AL, 50cm BPL)
- Results: (pp population)
  - FU rate 68%
  - % excess BMI loss: 75.6 vs 71.4
  - GERD: 41% vs 18% (6/127 conversion to RYGB)
  - Co-morbidities: no difference
  - Nutritional status no difference (at 2y FU: OAGB more SAE)





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

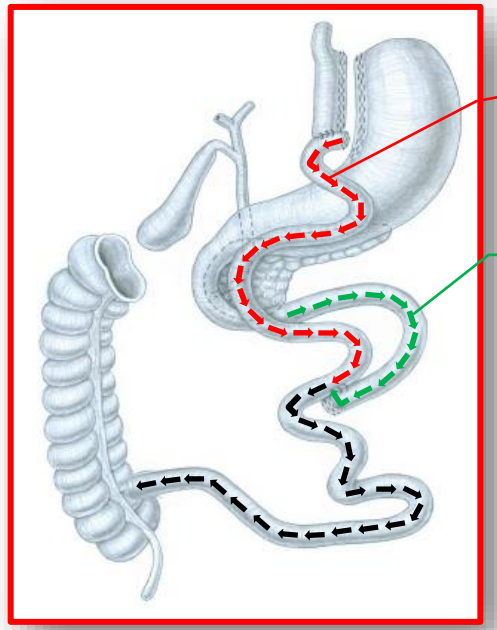
Long BPL RYGB



AL = 80 cm

BPL = 180 cm

Short BPL RYGB

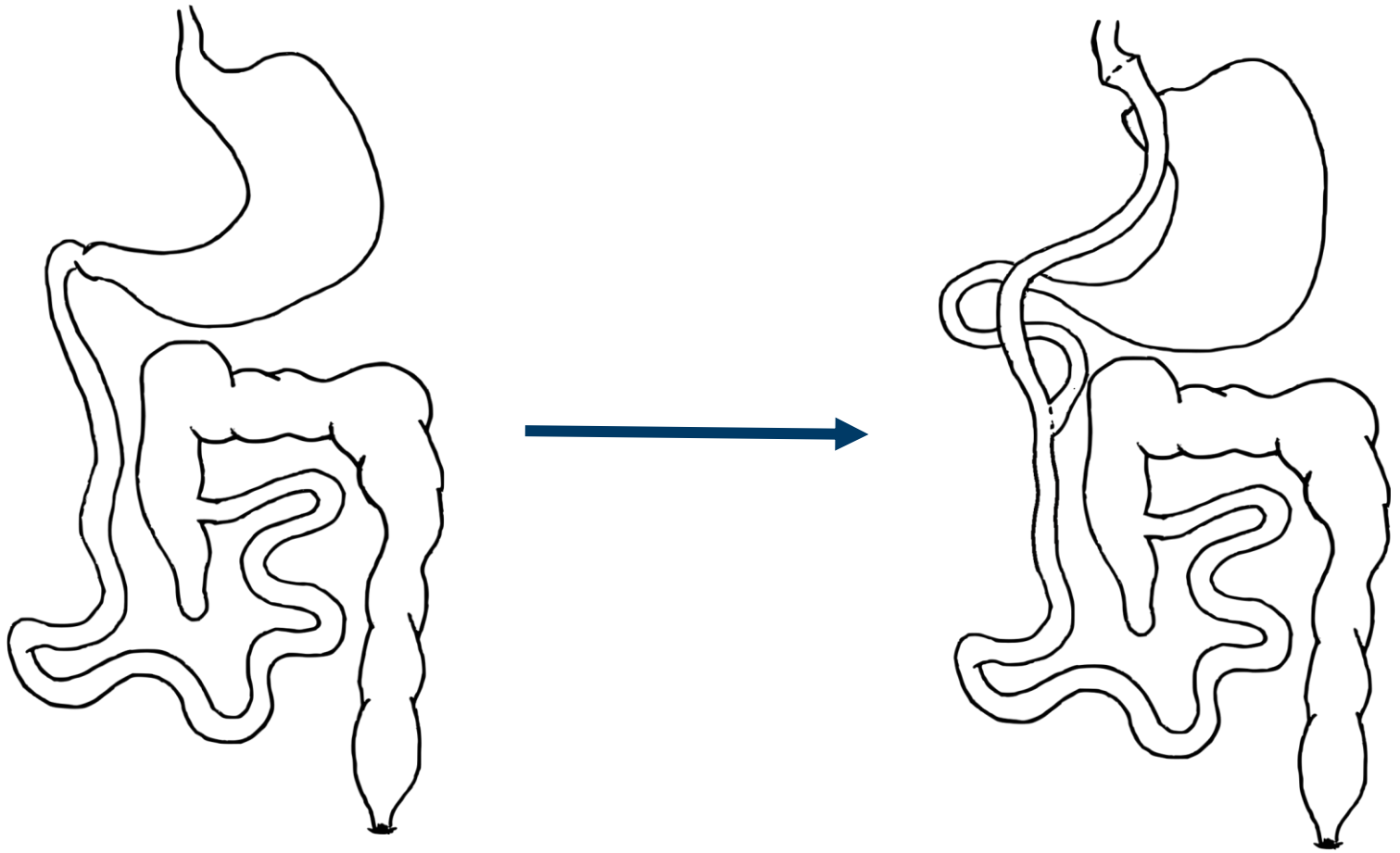


AL = 180 cm

BPL = 80 cm

Mouse Model

longer BPL



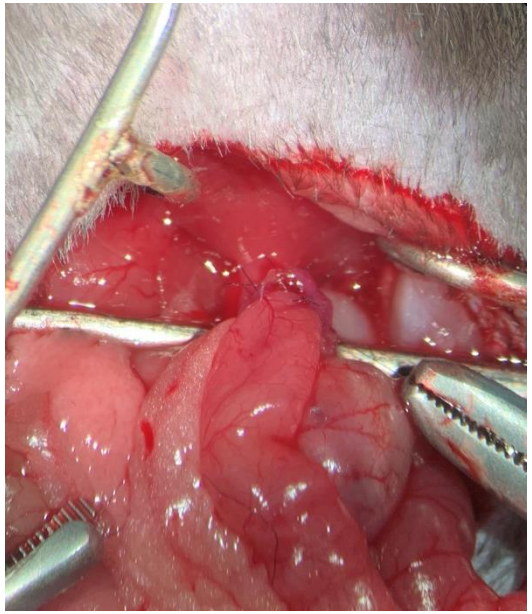
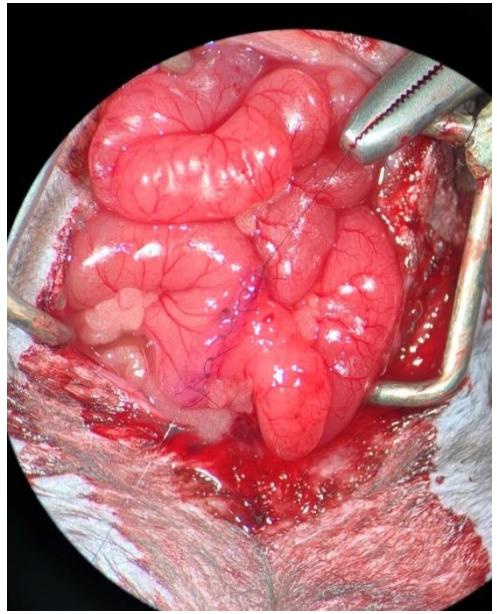
Mouse Model

longer BPL

Departement Biomedizin Basel

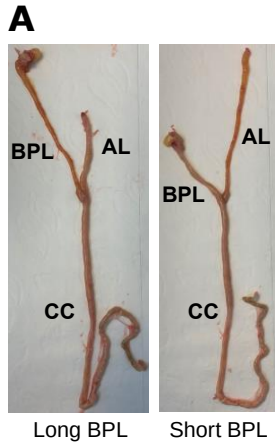
- Male C57Bl/6J six weeks old
- Wild type
- High Fat Diet
- Induced obesity and diabetes

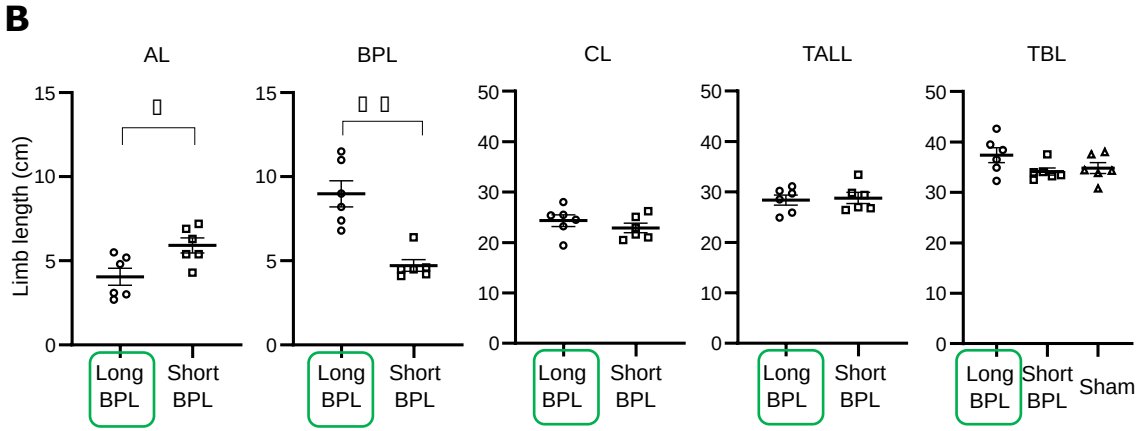


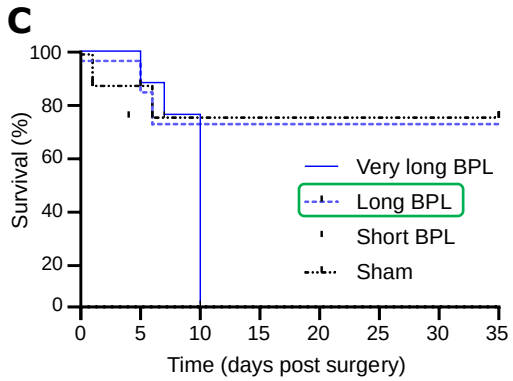
Mouse Model: *longer BPL*

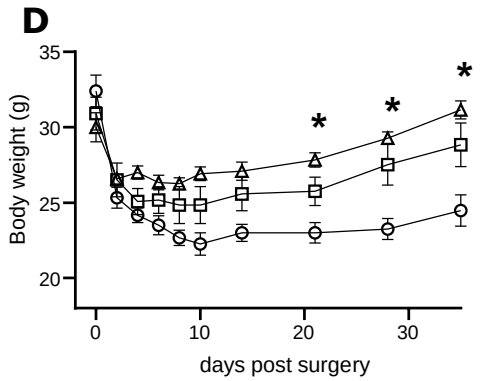
- Groups
  - Sham
  - Short BPL
  - Long BPL
  - Very long BPL

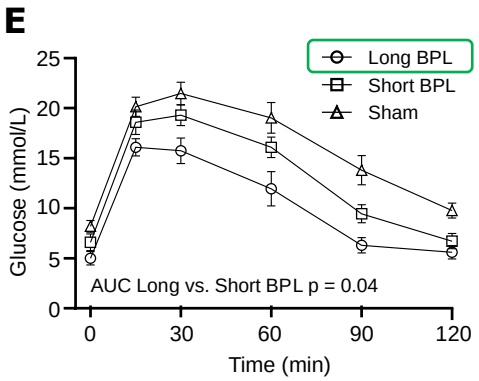




- Long BPL:
  - Better weight loss
  - Better GTT
- Very long BPL:
  - Starvation





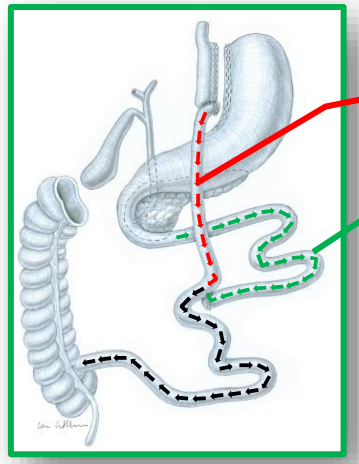


Swiss Multicenter RCT on Different Limb Lengths in Gastric Bypass Surgery (SLIM)

- 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

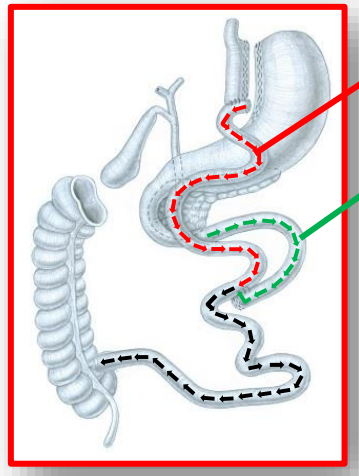
- Outcomes:
  - Composite primary outcome:
    - % weight loss (superiority) & deficiency rate (non-inferiority) at 5 y
  - Secondary outcomes:
    - Effectivity (Remission of comorbidities, QoL)
    - Safety
    - Influence of all limbs on all outcomes in subgroup analysis
    - Part II (Clarunis) impact on body composition and bone metabolism
    - Part III (Clarunis, Zürich) mechanistic studies
    - ……

Long BPL RYGB



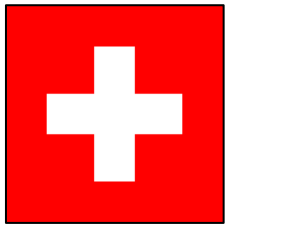
mean CL = CL

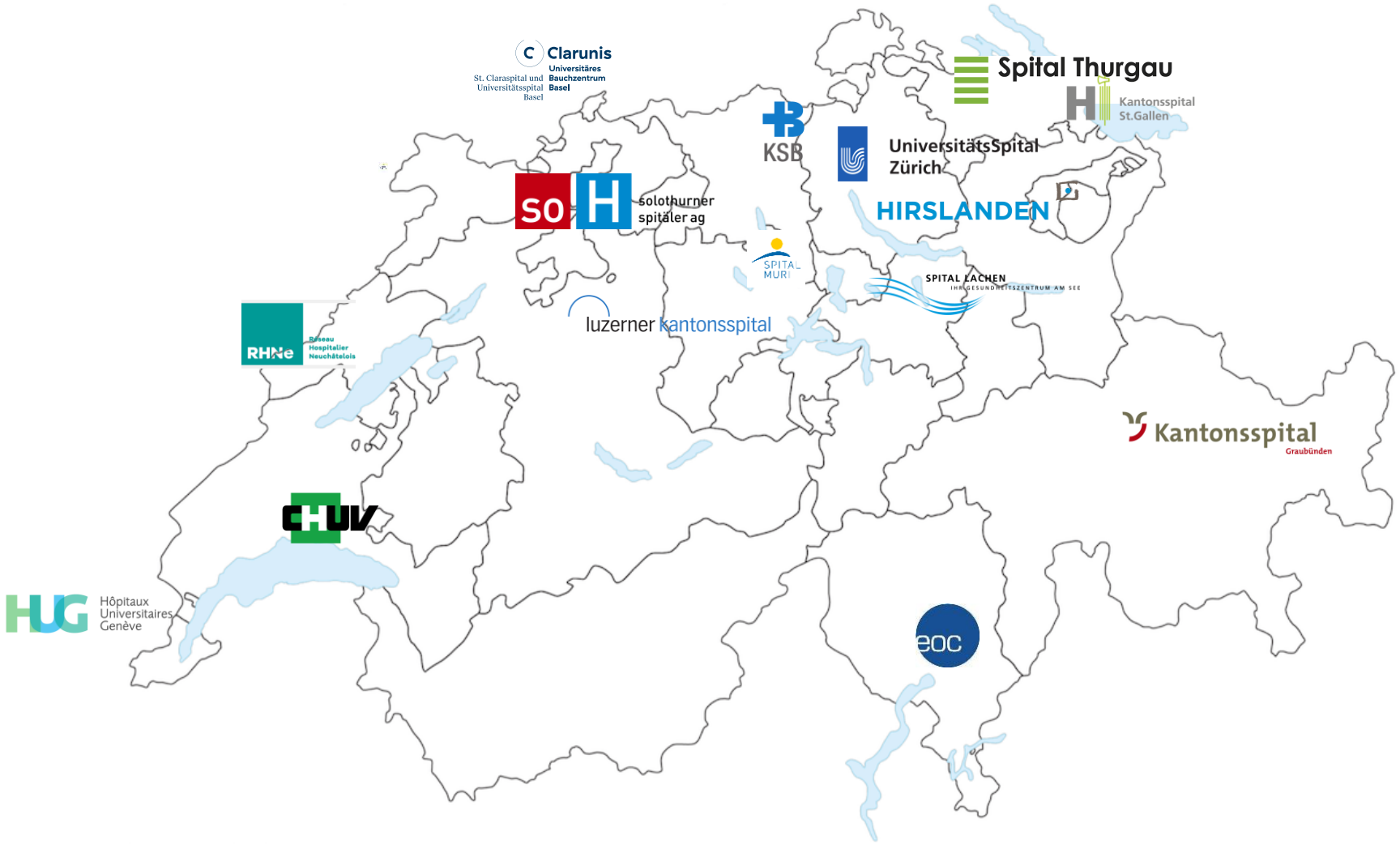
Short BPL RYGB



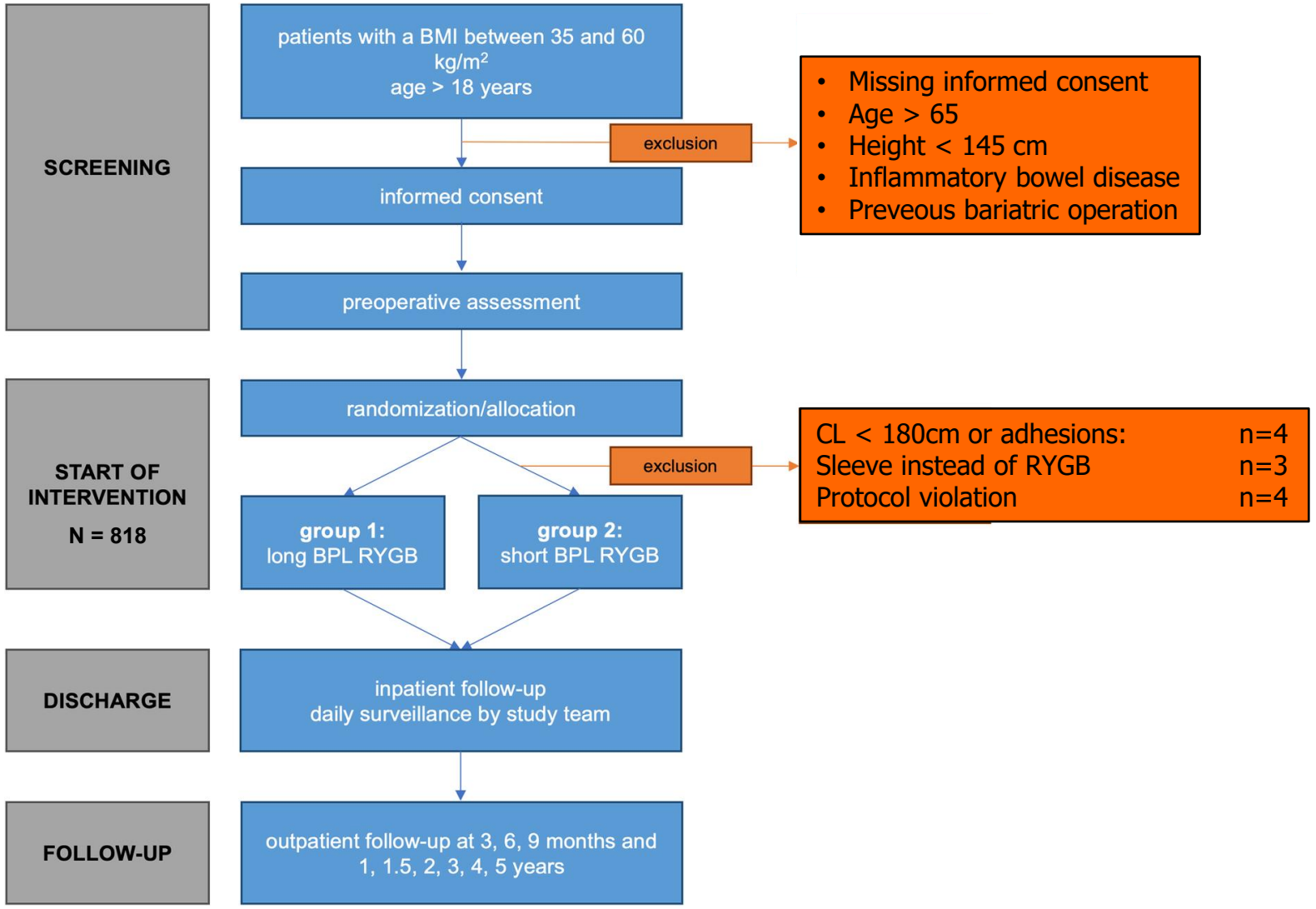
Swiss National Science Foundation

Participating Centers





Study Flow Chart



SLIM Trial - Early Results

Baseline Characteristics

	Long BPL (n=402)	Short BPL (n=405)	p
Female (%)	70.1	74.6	ns
Age (y)	41.8 ± 10.6	41.7 ± 11.7	ns
Weight	119.2 ± 18.8	120.0 ± 20.5	ns
BMI (kg/m^2)	42.5 ± 6.1	42.6 ± 5.2	ns
T2 Diabetes (n, %)	92 (22.8)	57 (14.1)	0.01
Dyslipdemia	229 (57.0)	229 (56.5)	ns
Hypertension	160 (39.7)	176 (43.4)	ns
OSAS	170 (42.3)	175 (43.2)	ns
GERD	172 (42.8)	179 (44.2)	ns

SLIM Trial - Early Results

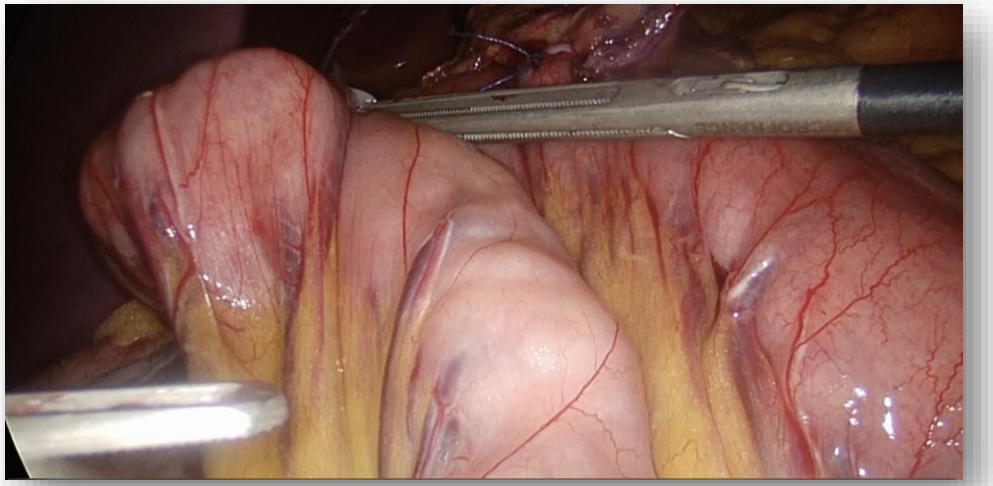
Intraoperative Parameters

	Long BPL (n=402)	Short BPL (n=405)	p
Access (%)			ns
• Open	0	0	
• Laparoscopic	93.6	93.4	
• Robotic	6.4	6.6	
• Conversion	0.2	0	
Gastroenterostomy (%)			ns
• Hand sewn	15.5	13.5	
• Linear	45.7	46.9	
• Circular	38.8	39.5	
Roux limb (%)			ns
• Antecolic	74	73	
• Retrocolic	26	27	
Duration (>25% instruction procedures)			ns
• Total	130.1 ± 38.9	125.1 ± 34.9	
• Additional operation (CE, HH repair...)	20.3 ± 16.7	20.8 ± 19.6	
• Small bowel measurement	13.4 ± 8.0	13.8 ± 10.6	

SLIM Trial - Preliminary Results

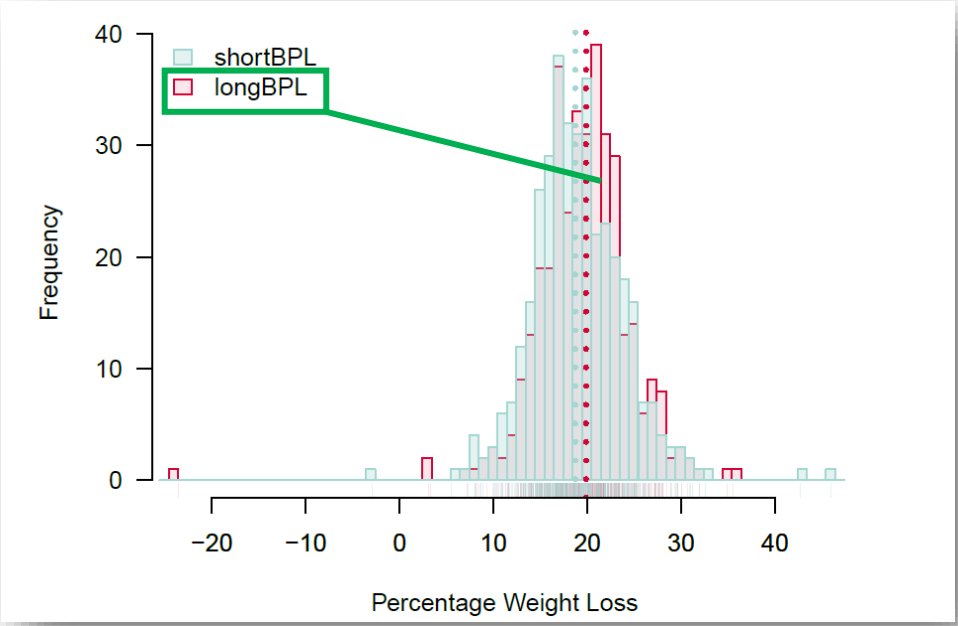
Intraoperative Parameters

- Total bowel length measurement
  - Technique:
    - Measure band: 30%
    - Marked forceps 10cm: 10%
    - Marked forceps 5cm: 60%
  - Duration: <14 min
  - Associated complications: 19/807 (2.4%)
    - 2 perforations, 17 serosal lesions
    - 12/19 (63.2%) with measure band!
  - Complete measurement:
    - Complete: 89%
    - Incomplete: 7.1%
    - Missing: 3.9%
  - Mean small bowel length: 653 ± 113 cm (min 300 cm, max 1050 cm)



SLIM Trial - Early Results 3m *Weight loss*

	Long BPL (n=402)	Short BPL (n=405)	p
Weight, kg	95.8 ± 16.1	97.0 ± 16.8	ns
BMI, kg/m^2	33.9 ± 5.2	34.6 ± 4.7	ns
TWL, %	19.6 ± 8.4	19.2 ± 7.6	ns
EBMIL, %	50.9 ± 25.5	45.4 ± 24.3	0.038



SLIM Trial - Early Results 3m

Deficiencies / Morbidity

	Long BPL (n=402)	Short BPL (n=405)	p
Deficiencies, n (%)	182 (45.3)	178 (43.9)	ns
Complications			
• Clavien-Dindo III (%)	6.5	4.8	ns
• Clavien-Dindo IV (%)	0.3	0.6	ns
• Clavien-Dindo V (%)	0	0	ns

Summary

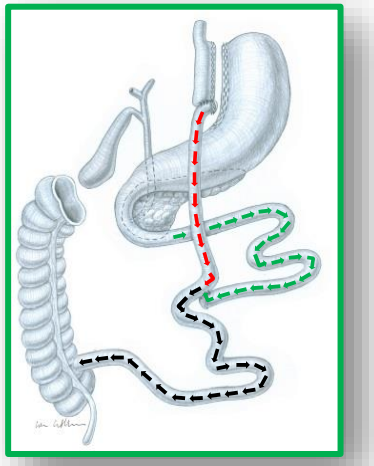
Preliminary Results of SLIM TRial

- Total small bowel length varies ~ 7 m (3.5 – 13 m)
  - SLIM: 653 ± 113 cm (min 300 cm, max 1050 cm)

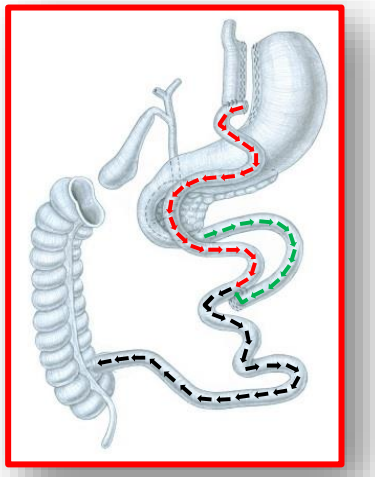
- Small bowel measurement:
  - >90% possible
  - Takes < 14 min.
  - 1 additional trocar
  - Low risk (2/807 perforations)

- Longer BPL may lead to:
  - Improved weight loss
  - Better metabolic effect (T2DM, dyslipidemia) ?
  - BUT: more deficiencies ?
    - up to 3 months no

Long BPL RYGB



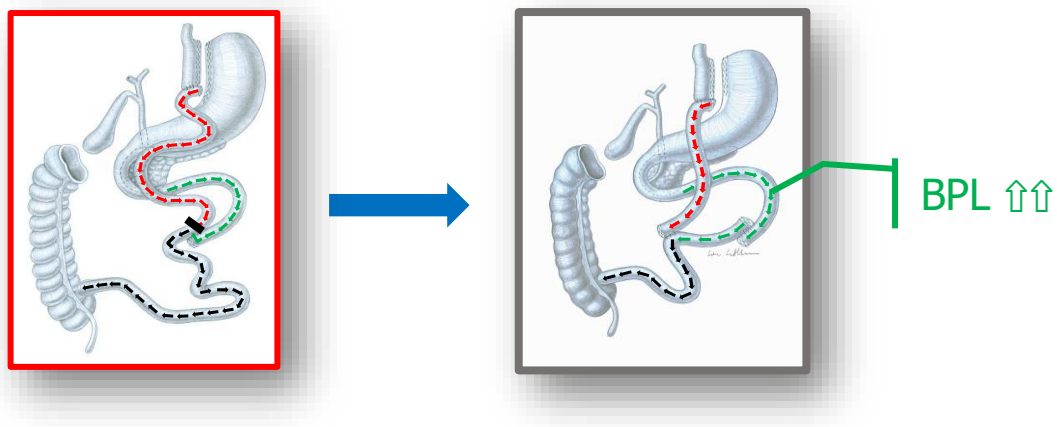
Short BPL RYGB



Conclusion

Is there optimal BP-limb length? Standard limb lengths or a tailored approach?

- Evidence for:
  - Minimal length of TAL in primary RYGB: 4m, in revisional RYGB: 3 (2.8) m
  - Better efficacy = more deficiencies
    → Balance between optimizing weight loss while avoiding malnutrition
- Today: ideal length of AL / BPL and CL not known
  - Tailored to the total bowel length?
  - Tailored to initial BMI, other parameters?
  - BPL always 150-200 cm?
  - SLIM trial will be able to analyse all segments involved
- If longer BPL:
  - Patient and FU physician must know increased risks
  - Suboptimal weight loss after standard RYGB: increasing the BPL:*
    - Additional weight loss of 10 BMI points (EWL = 69%)
    - Excellent FU mandatory (similar to BPD patients)
    - But 5% Malnutrition (lengthening of CL)



Thanks to

multiple Swiss bariatric centres

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