Marginal ulcer: technical problem ?

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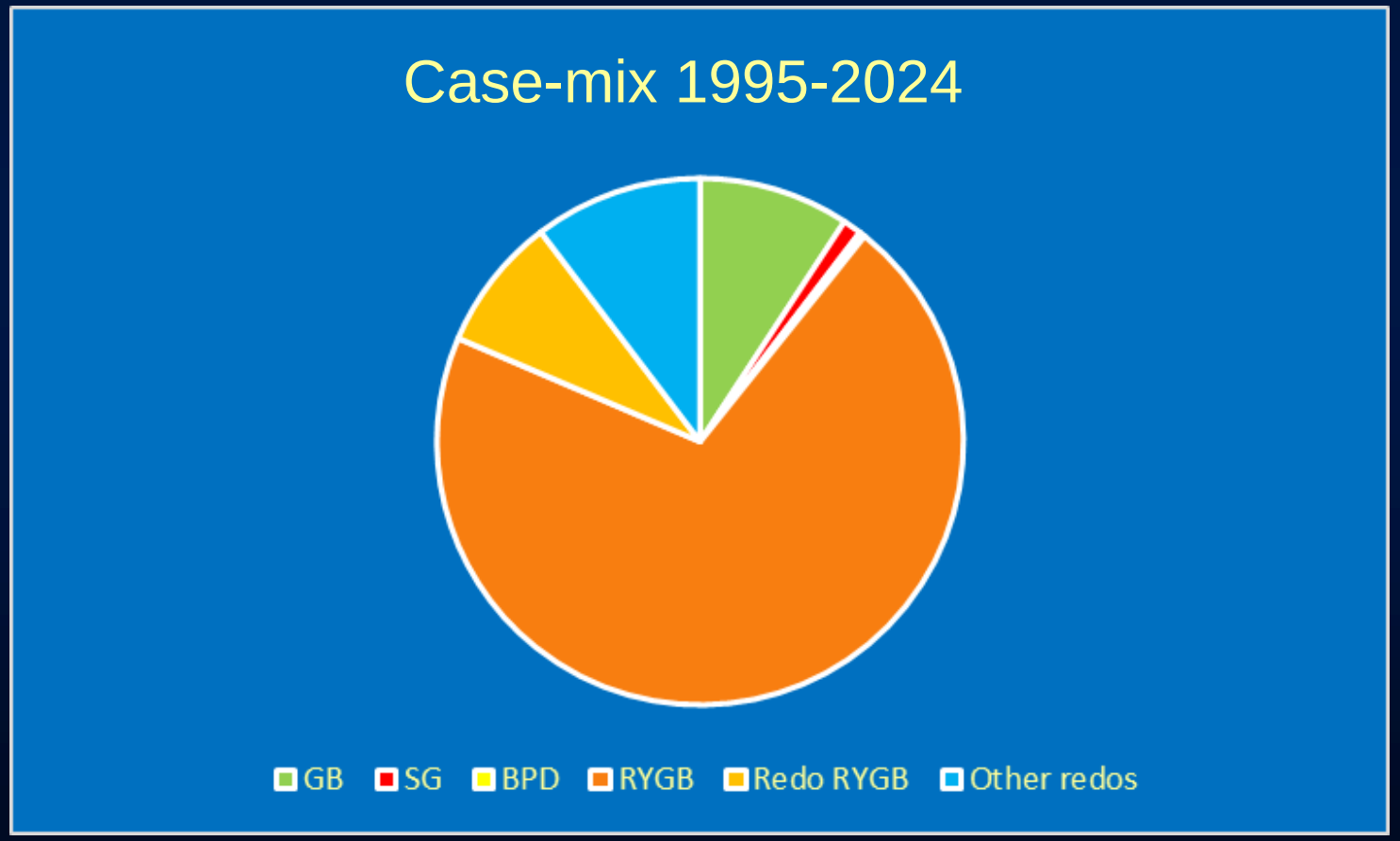
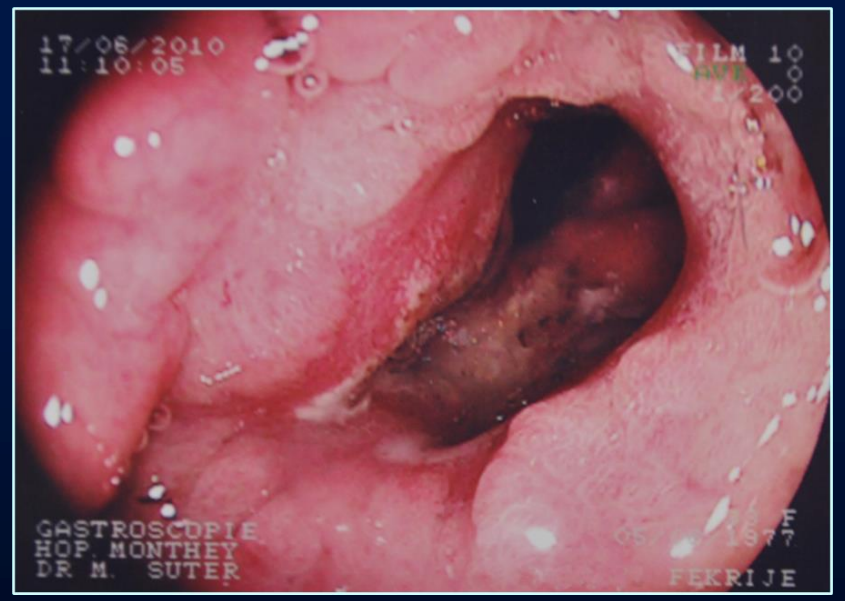
Disclosures

Nothing to disclose



Marginal ulcers: the problem

- Affects 0,5 – 16 % after Roux-en-Y gastric bypass
- Can be asymptomatic in up to 25 % of cases
- Can be complicated
  - Bleeding
  - Perforation
  - Erosion into adjacent organ
  - Stricture at the GJS
- Early and late complication



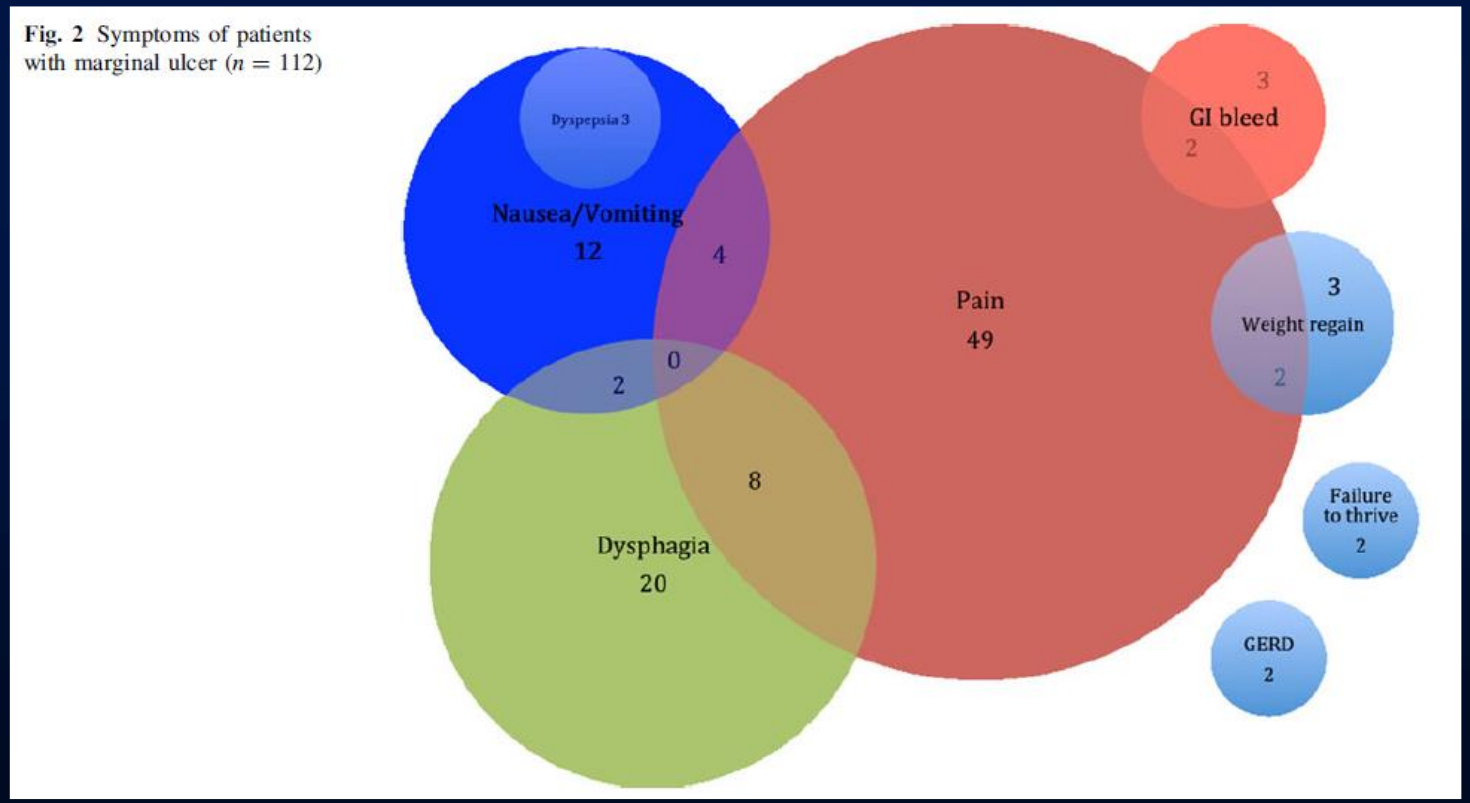
Marginal ulcer after Roux-en-Y gastric bypass: what have we really learned?

K. El-Hayek · P. Timratana · H. Shimizu · B. Chand

Surg Endosc (2012) 26:2789–2796
DOI 10.1007/s00464-012-2280-x

328 consecutive patients with symptoms submitted to upper GI endoscopy

→ Marginal ulcer diagnosed in 112 (34%) of patients



Incidence and Prognostic Factors for the Development of Symptomatic and Asymptomatic Marginal Ulcers After Roux-en-Y Gastric Bypass Procedures

Julian Süsstrunk[1,2] · Lara Wartmann[3] · Diana Mattiello[1] · Thomas Köstler[1] · Urs Zingg[1]

Obesity Surgery (2021) 31:3005–3014

- 568 RYGB: routine endoscopy @ 2 and 5 years in 55 and 38 % of eligible patients:
- 86 (15,1 %) of patients developed MU, asymptomatic in 24,4 %

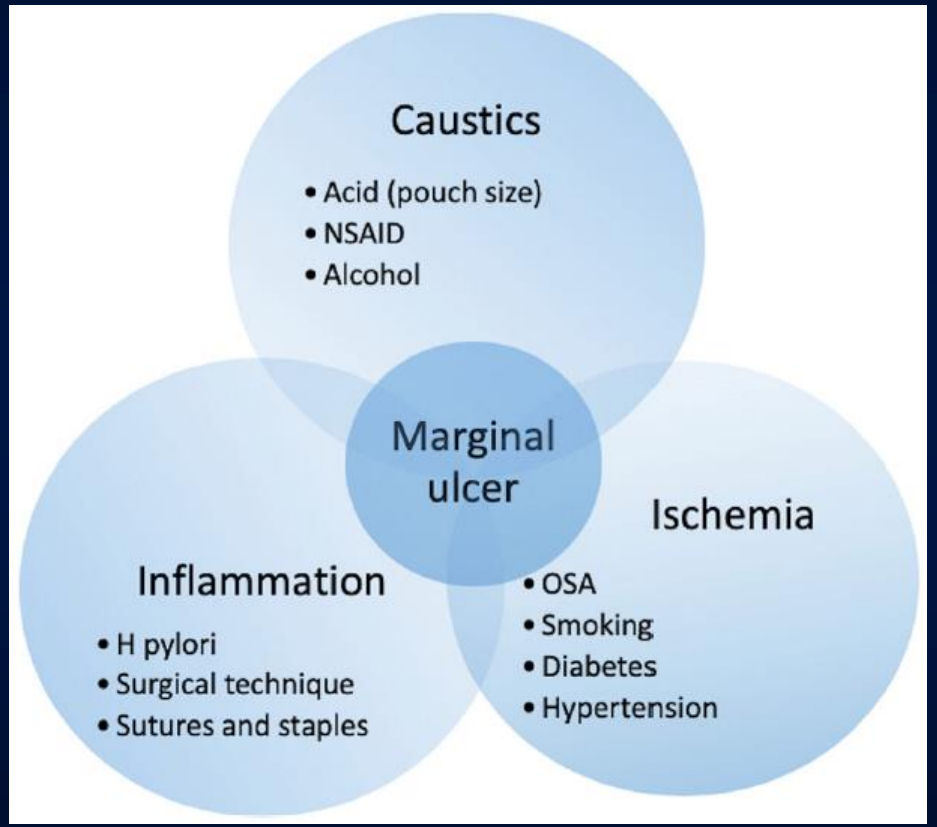
Table 3 Multivariate logistic regression of potential prognostic factors for the development of marginal ulcers

Covariates	HR	95% CI	*p* value
HbA1c	1.18	1.00–1.40	0.045
Current smoker	2.65	1.64–4.23	< 0.001
Alcohol consumption 2–3× weekly	1.40	0.88–2.24	0.157
Alcohol consumption daily	1.67	0.74–3.76	0.216
Non-steroidal anti-inflammatory drugs	1.05	0.52–2.13	0.891
Corticosteroids	1.63	0.61–0.75	0.218
OSAS	1.21	0.76–1.92	0.422
Anticoagulants	1.60	0.86–2.99	0.139

HR hazard ratio, *CI* confidence interval, *OSAS* obstructive sleep apnea syndrome

Marginal ulcers: risk factors

- Smoking
- NSAIDS
- Steroids
- Pouch size
- Ischemia
- Foreign bodies (staples, sutures)
- Anastomotic technique
- Ante- versus retro-colic Roux limb
- Gastro-gastric fistula
- Medical conditions (diabetes, DVT)
- Helicobacter pylori?



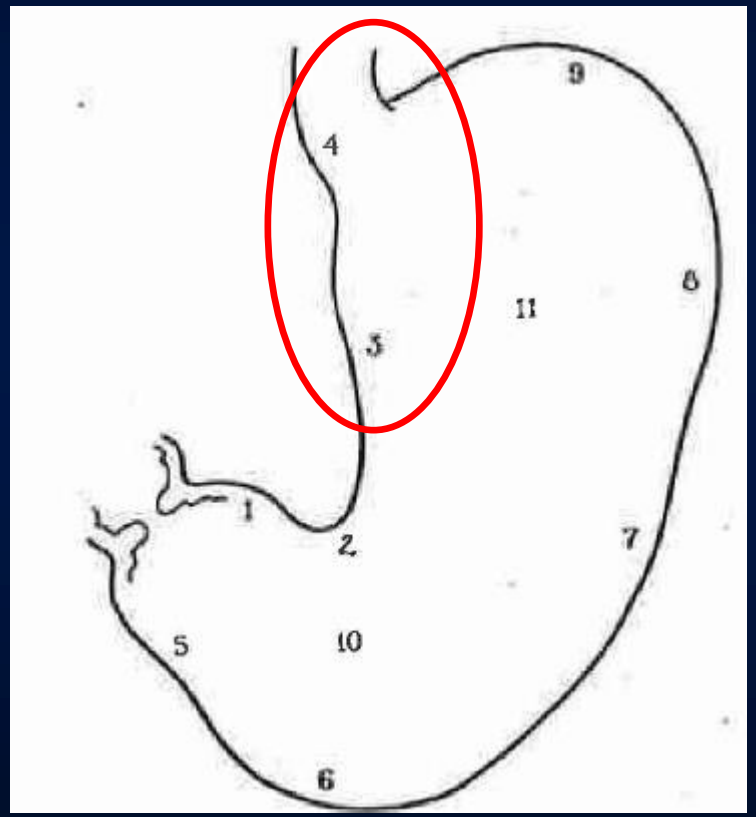
Duarte-Chavez et al, Obes Surg 2020; 30: 4821

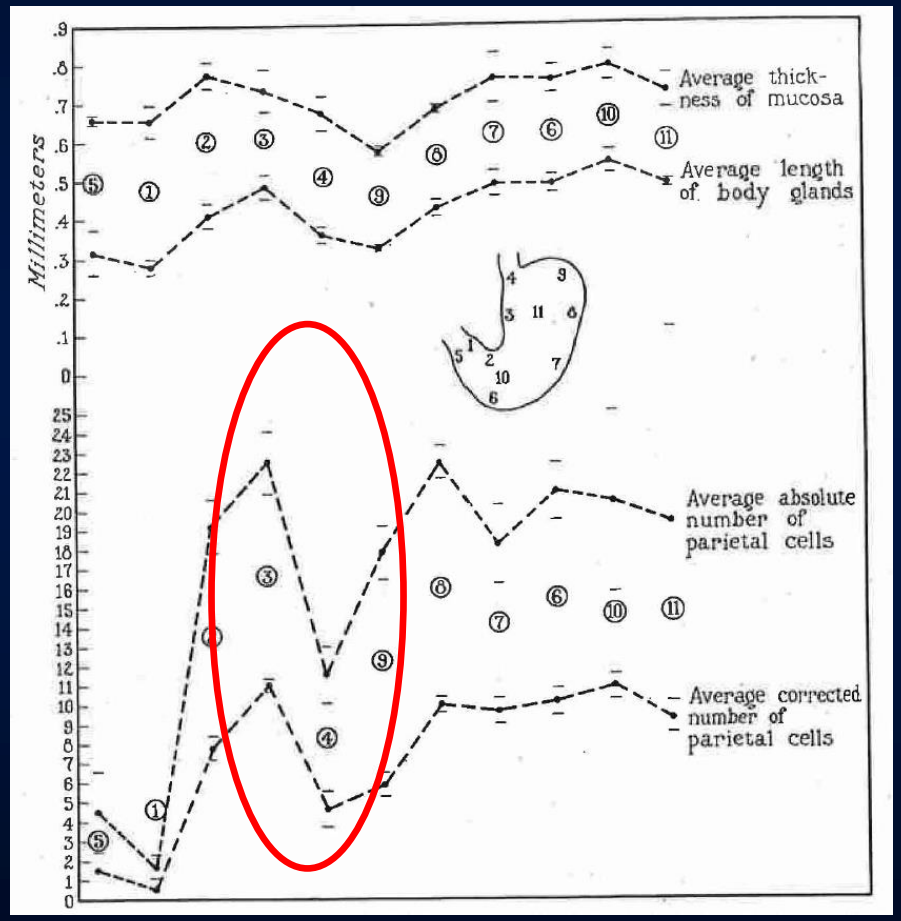
Marginal ulcers: the role of acid

THE DISTRIBUTION OF PARIETAL CELLS IN THE STOMACH: A HISTOTOPOGRAPHIC STUDY [1]

EDMUND H. BERGER

The Mayo Foundation, Rochester, Minnesota





Berger EH. The American Journal of Anatomy 1934; 54: 87

The Proximal Gastric Pouch Invariably Contains Acid-Producing Parietal Cells in Roux-en-Y Gastric Bypass

Helene Siilin, MD[1]; Alkwin Wanders, MD, PhD[2]; Sven Gustavsson, MD, PhD[1]; Magnus Sundbom, MD, PhD[1]

Obesity Surgery, 15, 771-777

23 patients: - 13 with 3x4 cm pouch
- 10 with 2x3 cm pouch

Histological examination of donut after CSA

High proportion of parietal cells found in every specimen

Conclusion: make the pouch as small as possible to limit the number of parietal cells in the pouch, hence acid secretion

Role of Gastric Acid in Stomal Ulcer after Gastric Bypass

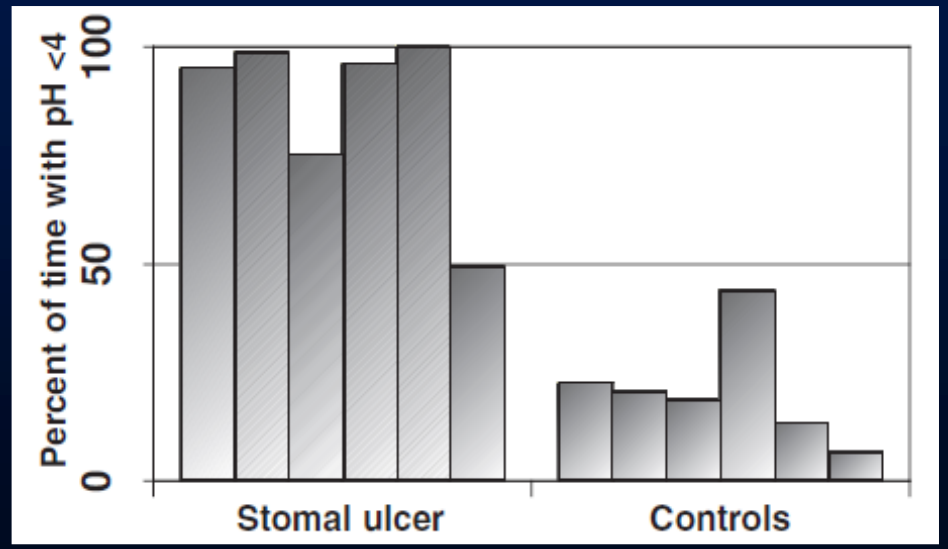
Jakob Hedberg, MD[1]; Hans Hedenström, MD, PhD[2]; Sven Nilsson, MD, PhD[3]; Magnus Sundbom, MD, PhD[1]; Sven Gustavsson, MD, PhD[1]

Obesity Surgery, 15, 1375-1378

6 patients with marginal ulcer after RYGB underwent a 24-h pH-study

Table 1. Clinical data on stomal ulcer patients

Patient #	Age at RYGBP surgery (years)	Gender M/F	Revisional Procedure Y/N	Peritoneal approach at RYGBP	Time of diagnosis after RYGBP	Percent of Time with pH <4
1	50	F	N	Lap	3 weeks	95
2	35	F	N	Lap	3 weeks	99
3	35	F	N	Lap	1 year	75.3
4	37	M	N	Open	4 weeks	96
5	45	F	Y	Open	5 years	100
6	40	F	Y	Open	4 weeks	49.6

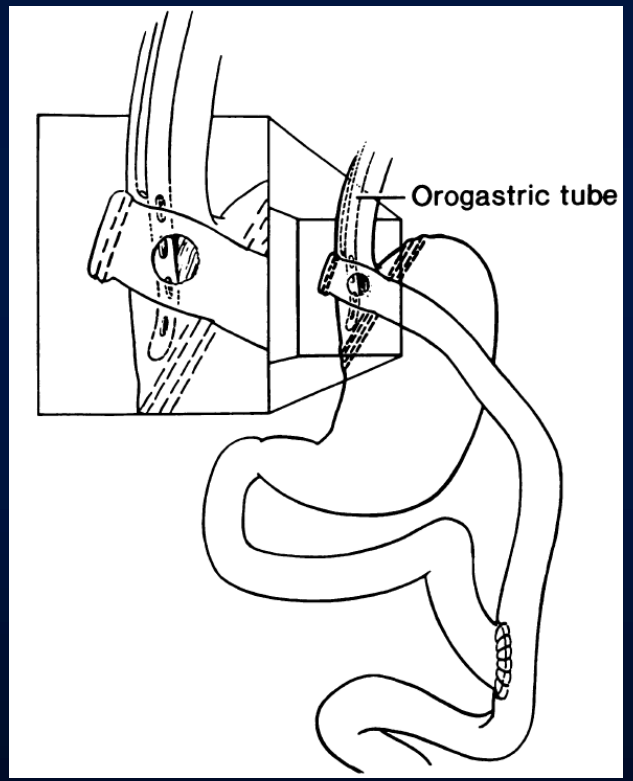


Prospective Evaluation of Gastric Acid Secretion and Cobalamin Absorption Following Gastric Bypass for Clinically Severe Obesity

Digestive Diseases and Sciences, Vol. 39, No. 2 (February 1994), pp. 315–320

KEVIN E. BEHRNS, MD, C. DANIEL SMITH, MD, and MICHAEL G. SARR, MD

Measurement of basal and pentagastrin-stimulated acid secretion in pouch after RYGB



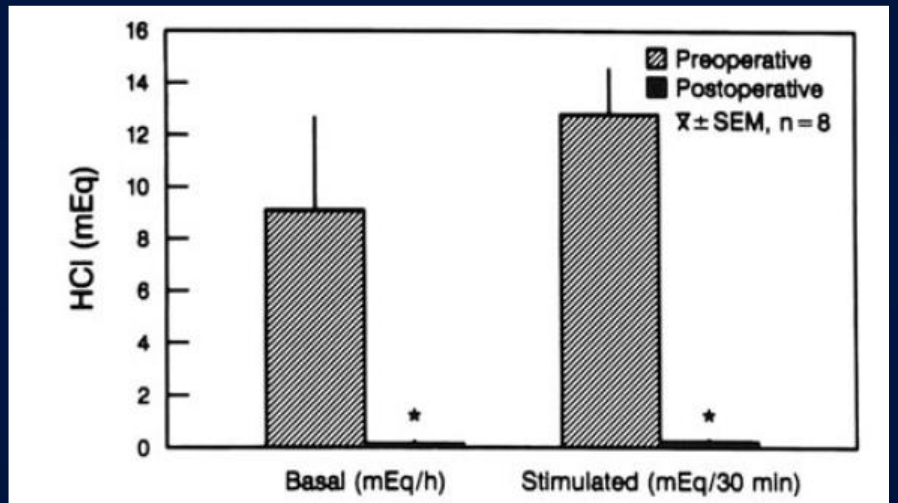


Fig 2. Preoperative and postoperative gastric acid secretion in the basal and stimulated (pentagastrin, 6 μg/kg) states (*$P < 0.05$ from preop).

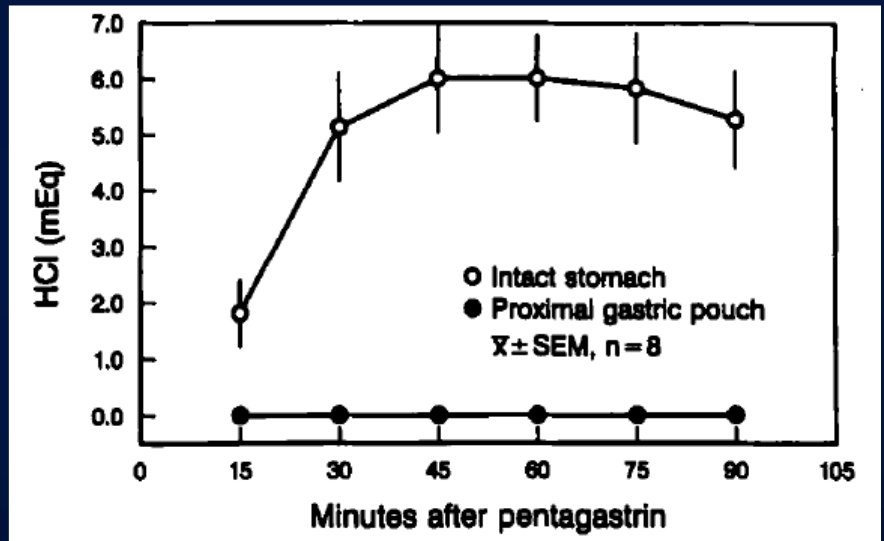


Fig 3. Gastric acid secretion after pentagastrin stimulation (6 μg/kg) of the native stomach and the gastric pouch.

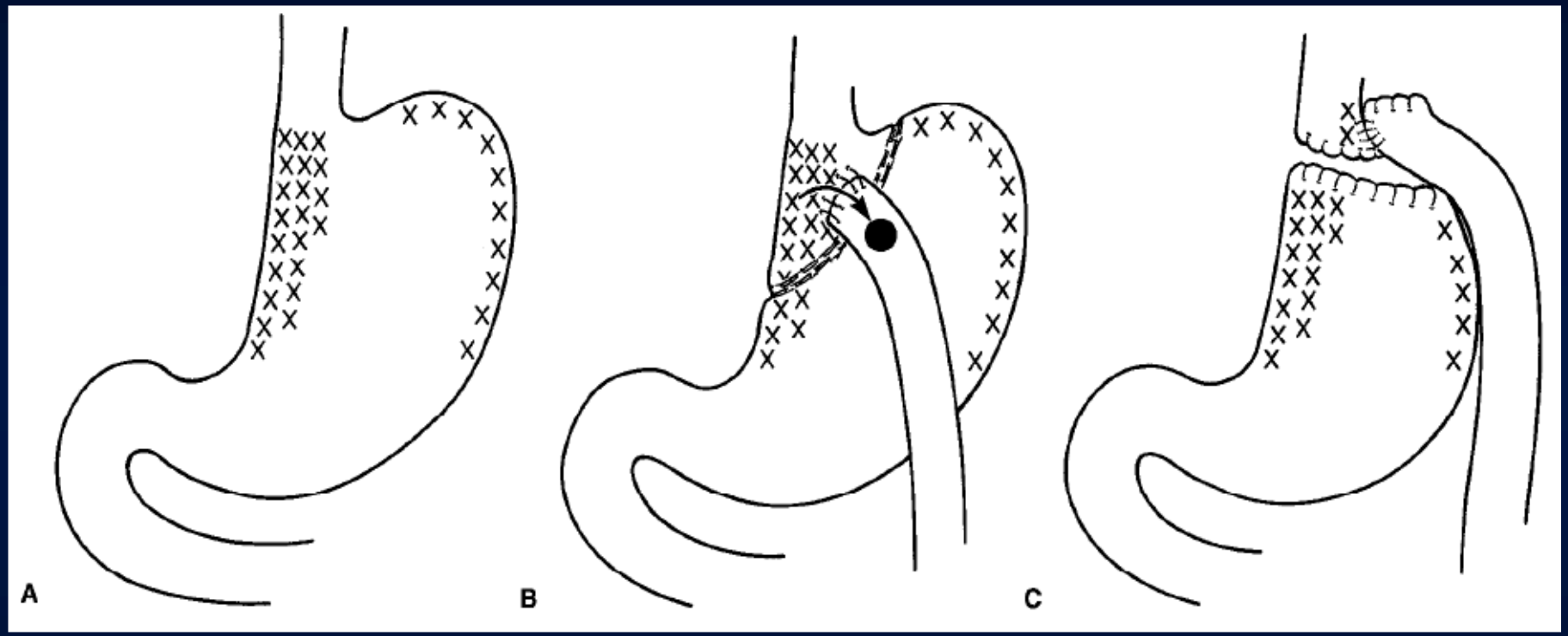
Conclusions:

Acid secretion virtually absent if the gastric pouch is very small after RYGB

Marginal Ulcer After Gastric Bypass: A Prospective 3-Year Study of 173 Patients

Obesity Surgery, 8, 505–516

James A. Sapala, MD, FACS;[1,3] Michael H. Wood, MD, FACS;[2]
M. Andrew Sapala, MD, FACS;[3] Thomas M. Flake, Jr., MD, FACS[4]



C. Near-total gastric bypass with very small pouch

173 patients

1 MU (0,6 %)

- Pouch should be small and limited to the cardia
- HP eradication before operation

Importance of pouch size in laparoscopic Roux-en-Y gastric bypass: a cohort study of 14,168 patients

David Edholm[1] · Johan Ottosson[2] · Magnus Sundbom[1]

Surg Endosc (2016) 30:2011–2015

- SOREG registry with > 25’000 RYGB. 44 centers
- Length of pouch staple line available in 16241 patients
- 87 % complete one-year follow-up

Table 2 Presence of marginal ulcer at 6 weeks or 1 year, correlated with gender, age, preoperative BMI, diabetes and stapler length by multivariate logistic regression

	After 6 weeks		After 1 year	
	p	Odds ratio with (95 % confidence interval)	*p*	Odds ratio with (95 % confidence interval)
Male gender	.18	.67 (.37–1.20)	.96	.98 (.95–1.02)
Age at surgery (years)	.34	.99 (.96–1.01)	.53	1.01 (.99–1.02)
Preoperative BMI (kg/m^2)	.65	.99 (.95–1.03)	.31	.98 (.95–1.02)
Diabetes	.29	1.39 (.74–2.59)	.27	1.30 (.82–2.05)
Length of staplers used for pouch (cm)	<.001	1.10 (1.03–1.18)	<.001	1.14 (1.09–1.20)

BMI Body mass index

- Each additional cm increases the risk of MU by 14 %

Original article

Acid-related complications after laparoscopic Roux-en-Y gastric bypass: risk factors and impact of proton pump inhibitors

Jeff Wennerlund, M.D.[a,*], Ulf Gunnarsson, M.D., Ph.D.[a], Karin Strigård, M.D., Ph.D.[a], Magnus Sundbom, M.D., Ph.D.[b]

Surgery for Obesity and Related Diseases 16 (2020) 620–625

- Analysis of acid-related complications 1 month and 1 year after RYGB based on SOREG registry (37'701 patients)

Logistic regression analysis of variables that predispose for complications 0 to 30 days post LRYGB

	Odds ratio	95% confidence interval	*P* value
Marginal ulcer			
Hypertension	1.433	.974–2.108	.068
Diabetes	1.243	.795–1.945	.341
Operation time >63 min	2.189	1.534–3.126	<.000
Lower income	.991	.890–1.103	.870
No college education	.949	.883–1.021	.162
Immigrant background	1.721	1.170–2.531	.006
Stricture			
BMI	1.696	1.033–2.784	.038

LRYGB = laparoscopic Roux-en-Y gastric bypass; BMI = body mass index.
Multivariate analysis of significant univariate variables.

Logistic regression analysis of variables that predispose for complications 31 to 365 days after LRYGP

	Odds ratio	95% confidence interval	*P* value
Marginal ulcer			
Age >41 yr	1.352	.923–1.980	.122
Diabetes	1.746	1.143–2.668	.010
Dyspepsia	1.706	1.058–2.751	.028
Stapling length >150 mm	2.185	1.528–3.248	<.000
Operation time >63 min	1.667	1.108–2.510	.014
Smoking	2.586	1.768–3.782	<.000
Inferior weight loss, EWL* <81%	1.496	1.040–2.152	.030
Immigrant background	1.600	1.085–2.361	.018
Perforation			
Lower education	.895	.572–1.399	.626
Unmarried	1.216	.717–2.061	.469
Urban resident	.770	.443–1.338	.354
Stricture			
Age >41 yr	2.204	1.048–4.633	.037

Conclusion: longer pouch increases the risk of marginal ulcer

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Marginal ulcers: the role of the technique used for the gastro-jejunostomy

Circular stapling
Linear stapling
Hand-sewn
Robotic-hand-sewn

Comparison of Hand-Sewn, Linear-Stapled, and Circular-Stapled Gastrojejunostomy in Laparoscopic Roux-en-Y Gastric Bypass

Frank P. Bendewald · Jennifer N. Choi · Lorie S. Blythe · Don J. Selzer · John H. Ditslear · Samer G. Mattar

OBES SURG (2011) 21:1671–1675
DOI 10.1007/s11695-011-0470-6

Retrospective study of 882 patients with RYGB comparing techniques used for the gastrojejunostomy

- Circular stapling
- Linear stapling
- Hand-sewn

Table 2 Early anastomotic complications associated with GJA technique

	Hand-sewn (n=181)	Linear stapler (n=514)	Circular stapler (n=140)	p value
Leak	2 (1.1%)	5 (1.0%)	0 (0%)	0.480
Stricture	11 (6.1%)	31 (6.0%)	6 (4.3%)	0.657
Marginal ulcer	14 (7.7%)	41 (8.0%)	5 (3.6%)	0.180

No difference

Linear-stapled Versus Circular-stapled Laparoscopic Gastrojejunal Anastomosis in Morbid Obesity: Meta-analysis

Marta Penna, MBBS, BSc, Sheraz R. Markar, MRCS, MA,* Vishal Venkat-Raman, MBBS, BA,* Alan Karthikesalingam, MRCS, MA,† and Majid Hashemi, MD, FRCS**

(*Surg Laparosc Endosc Percutan Tech* 2012;22:95–101)

Review of studies comparing circular and linear stapling for the GJS

9 studies included

4 studies reported rates of MU (603 LS versus 223 CS)

No difference between the two techniques

Original article

Gastrojejunostomy technique and anastomotic complications in laparoscopic gastric bypass

Alex W. Lois, B.S., Matthew J. Frelich, M.S., Matthew I. Goldblatt, M.D., James R. Wallace, M.D., PhD, Jon C. Gould, M.D.*

Medical College of Wisconsin, Department of Surgery, Milwaukee, Wisconsin

Received August 3, 2014; accepted November 8, 2014

Surgery for Obesity and Related Diseases 11 (2015) 808–813

Retrospective sgtudy comparing circular stapled and hand-sewn GJS

2 surgeons, 2 techniques

135 hand-sewn, 55 circular-stapled

Outcomes within 12 months after laparoscopic Roux-en-Y gastric bypass surgery

	Hand-sewn	Stapled	Cumulative	*P* value
Anastomotic Stenosis	4 (3.0%)	9 (16.4%)	13 (6.8%)	< .01
Marginal Ulcer	1 (0.7%)	3 (5.5%)	4 (2.1%)	.04
Wound Infection	0 (0.0%)	2 (3.6%)	2 (1.1%)	.16
Postop Bleeding	2 (1.5%)	6 (10.9%)	8 (4.2%)	< .01

Conclusions: higher rate of anastomotic complications including marginal ulcers with circular stapling

Original article

Comparison between circular- and linear-stapled gastrojejunostomy in laparoscopic Roux-en-Y gastric bypass—a cohort from the Scandinavian Obesity Registry

David Edholm, M.D., Ph.D.*, Magnus Sundbom, M.D., Ph.D.

Department of Surgical Sciences, Uppsala University, Uppsala, Sweden

Received December 19, 2014; accepted March 18, 2015

Surgery for Obesity and Related Diseases 11 (2015) 1233–1236

Registry study comparing linear and circular stapled GJS in SOREG (> 34'000 patients)

Operative data and postoperative results

	Total	Linear stapled with hand-sewn defect	Circular stapled	*P*
Operative time	73 ± 35 min	73 ± 34 min	114 ± 39 min	< .0001
Hospital stay (d)	2.1	2.0 ± 2.8	4.6 ± 6.1	< .0001
Anastomotic leakage	.9%	.8%	2.2%	.0005
Postoperative hemorrhage	2.0%	2.0%	3.5%	.01
Wound-related complication	.9%	.8%	6.9%	< .0001
Marginal ulcer at 1 yr	1.0%	1.0%	2.9%	< .0001
BMI at 1 yr (kg/m^2)	29.0 ± 4.6	29.0 ± 4.6	28.8 ± 4.5	.22
Excess BMI loss at 1 yr	80% ± 23%	80% ± 23%	81% ± 22%	.28
Total weight loss at 1 yr	32% ± 7.7%	32% ± 7.7%	33% ± 7.8%	.005

Conclusion: more anastomotic complications, longer OR time and longer hospital stay with CS

Original article

Comparison between circular- and linear-stapled gastrojejunostomy in laparoscopic Roux-en-Y gastric bypass—a cohort from the Scandinavian Obesity Registry

David Edholm, M.D., Ph.D.*, Magnus Sundbom, M.D., Ph.D.

Department of Surgical Sciences, Uppsala University, Uppsala, Sweden

Received December 19, 2014; accepted March 18, 2015

Surgery for Obesity and Related Diseases 11 (2015) 1233–1236

Registry study comparing linear and circular stapled GJS in SOREG (> 34'000 patients)

Baseline characteristics of 34,284 laparoscopic Roux-en-Y gastric bypass patients

Baseline characteristics	Total	Linear stapled with hand-sewn defect	Circular stapled	P
	n = 34,284	n = 33,742	n = 542	
Female gender	76%	76%	78%	.16
Age (yr)	40.9 ± 11.1	40.9 ± 11.1	40.4 ± 10.0	.32
BMI (kg/m^2)	42.4 ± 5.4	42.4 ± 5.4	42.7 ± 4.8	.09
Diabetic	14%	14%	15%	.40

Very limited experience with CS

Impacts of Gastrojejunal Anastomotic Technique on Rates of Marginal Ulcer Formation and Anastomotic Bleeding Following Roux-en-Y Gastric Bypass

Obesity Surgery (2021) 31:2921–2926

Naresh Sundaresan[1] · Mariel Sullivan[2] · B. Amy Hiticas[3] · Benedict Y. Hui[1] · Lauren Poliakin[1] · Kyle J. Thompson[2] · Iain H. McKillop[2] · Selwan Barbat[1] · Timothy S. Kuwada[1] · Keith S. Gersin[1] · Abdelrahman Nimeri[1]

Evaluation of all patients who had an upper GI endoscopy after RYGB and comparison of findings according to technique used for GJS:

Circular stapled (25 mm) - linear stapled - robotic hand-sewn

Roux limb always antecolic

194 (17,4 %) / 1112 patients underwent EGD

	EEA −652 (58.6%)	Linear −374 (33.6%)	RHS −86 (7.7%)	Total −1112 (100%)
Ulcer	58 (9.3%)	18 (4.8%)	5 (5.8%)	81 (7.3%)
Bleed	7 (1.1%)	8 (2.1%)	5 (2.3%)	17 (1.5%)
Bleeding intervention	2 (0.3%)	5 (1.3%)	1 (1.2%)	8 (0.7%)

$p < 0,05$

Impacts of Gastrojejunal Anastomotic Technique on Rates of Marginal Ulcer Formation and Anastomotic Bleeding Following Roux-en-Y Gastric Bypass

Obesity Surgery (2021) 31:2921–2926

Naresh Sundaresan[1] · Mariel Sullivan[2] · B. Amy Hiticas[3] · Benedict Y. Hui[1] · Lauren Poliakin[1] · Kyle J. Thompson[2] · Iain H. McKillop[2] · Selwan Barbat[1] · Timothy S. Kuwada[1] · Keith S. Gersin[1] · Abdelrahman Nimeri[1]

Evaluation of all patients who had an upper GI endoscopy after RYGB and comparison of findings according to technique u

Circular stapled (25 mm) - linear st

Possible explanations

More tension on GJS due to lack of reinforcing sutures in the CS technique
Higher proportion of EGD in patients with CS GJS
Antecolic Roux limb?

went EGD

		Linear −374 (33.6%)	RHS −86 (7.7%)	Total −1112 (100%)
	(58.6%)			
Ulcer	58 (9.3%)	18 (4.8%)	5 (5.8%)	81 (7.3%)
Bleed	7 (1.1%)	8 (2.1%)	5 (2.3%)	17 (1.5%)
Bleeding intervention	2 (0.3%)	5 (1.3%)	1 (1.2%)	8 (0.7%)

$p < 0,05$

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Comparison of circular- and linear-stapled gastrojejunostomy in laparoscopic Roux-en-Y gastric bypass: a multicenter study

Videosurgery Miniinv 2017; 12 (2): 140–146
DOI: https://doi.org/10.5114/wiitm.2017.66868

Piotr Major[1,2], Michał R. Janik[3], Michał Wysocki[2,4], Maciej Walędziak[3], Michał Pędziwiatr[1,2], Piotr K. Kowalewski[3], Piotr Małczak[1,2], Krzysztof Paśnik[3], Andrzej Budzyński[1,2]

Retrospective case-controlled study comparing LS and CS GJS

Parameter	LRYGB-LS (*n* = 99)	LRYGB-CS (*n* = 99)	P-value
Length of hospital stay, median (IQR) [days]	3 (2–4)	5 (3–5)	< 0.001[b]
Operative time, median (IQR) [min]	140 (100–180)	85 (70–115)	< 0.001[b]
Anastomotic leakage, *n* (%)	1 (1.0)	1 (1.0)	1.00[a]
Postoperative hemorrhage, *n* (%)	2 (2.1)	10 (10.3)	0.02[a]
Wound infection, *n* (%)	1 (1.0)	9 (9.3)	0.01[a]
Port site hernia, *n* (%)	4 (4.1)	1 (1.0)	0.18[a]
Anastomotic stricture, *n* (%)	1 (1.0)	1 (1.0)	1.00[a]
Marginal ulcer, *n* (%)	1 (1.0)	1 (1.0)	1.00[a]
Readmissions, *n* (%)	8 (8.2)	6 (6.1)	0.59[a]
Fatal cases, *n* (%)	1 (1.0)	0 (0)	–

Conclusion: no difference in terms of MU rates

Comparison of gastrojejunostomy techniques and anastomotic complications: a systematic literature review

Steliana Fakas[1] · Murad Elias[1] · Derek Lim[2] · Vadim Meytes[3]

Surgical Endoscopy (2021) 35:6489–6496
https://doi.org/10.1007/s00464-020-08142-x

Review of studies comparing CS, LS or HS GJS published within the last 5 years. Total > 135'000 patients

Only 5 studies reported on MU

- 3 studies comparing HS with CS
  - 1 showed no difference
  - 2 showed lower rates with HS
- 2 studies comparing LS with CS
  - 1 showed lower rates with LS
  - 1 showed no difference

Conclusion: mechanical GJS is associated with more complications than HS anastomosis. Further studies required

Linear Versus Circular Laparoscopic Gastrojejunal Anastomosis of Roux-en-Y Gastric Bypass: Systematic Review and Meta-Analysis of 22 Comparative Studies

Antonio Vitiello, MD, PhD, Giovanna Berardi, MD, Nunzio Velotti, MD, Vincenzo Schiavone, MD, Cristina Manetti, MD, and Mario Musella, MD

Surg Laparosc Endosc Percutan Tech • Volume 32, Number 3, June 2022

Meta-analysis of 22 studies comparing LS with CS GJS

Study or Subgroup	Linear Events	Linear Total	Circular Events	Circular Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Leyba 2008	0	40	1	40	4.9%	0.33 [0.01, 8.22]	2008
Giordano 2010	1	41	2	30	7.1%	0.35 [0.03, 4.05]	2010
Bendewald 2011	41	514	5	140	14.4%	2.34 [0.91, 6.04]	2011
Baccaro 2014	1	247	14	365	8.7%	0.10 [0.01, 0.78]	2014
Sima 2014	1	272	7	288	8.4%	0.15 [0.02, 1.21]	2014
Edholm 2015	337	33742	15	542	16.5%	0.35 [0.21, 0.60]	2015
Schneider 2016	3	171	1	57	7.7%	1.00 [0.10, 9.81]	2016
Major 2017	1	202	1	255	6.1%	1.26 [0.08, 20.33]	2017
Khalayleh (2017)	1	51	4	61	8.0%	0.28 [0.03, 2.63]	2017
Vines 2017	0	134	1	109	5.0%	0.27 [0.01, 6.67]	2017
Burla 2020	10	83	4	128	13.1%	4.25 [1.29, 14.03]	2020
Total (95% CI)		35497		2015	100.0%	0.61 [0.26, 1.41]	
Total events	396		55				

Heterogeneity: $Tau^2 = 1.06$; $Chi^2 = 28.53$, $df = 10$ ($P = 0.001$); $I^2 = 65\%$

Test for overall effect: $Z = 1.16$ ($P = 0.25$)

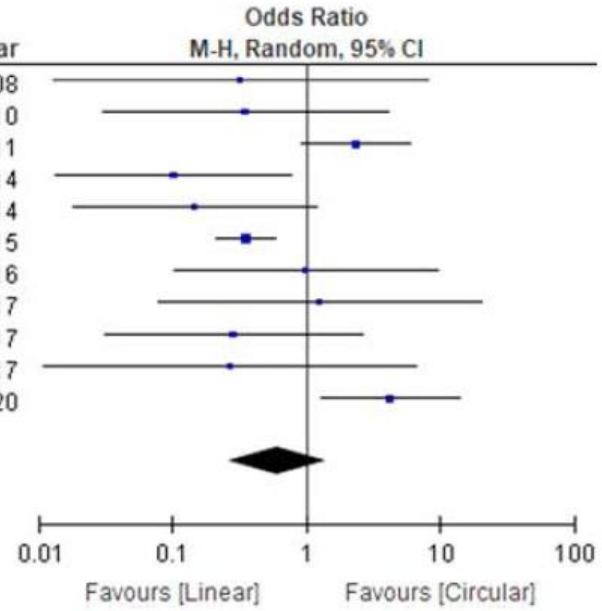

FIGURE 4. Forest plot showing a not significant decreased odds ratio of gastrojejunal anastomosis marginal ulcer after using linear versus circular stapler laparoscopic. CI indicates confidence interval.

Conclusions: both techniques are safe. No difference in MU rates

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HÔPITAL RIVIERA-CHABLAIS VAUD-VALAIS

Marginal ulcers: other technical aspects

Ischemia
Tension on the anastomosis
Type of sutures used

Comparison of Marginal Ulcer Rates Between Antecolic and Retrocolic Laparoscopic Roux-en-Y Gastric Bypass

Lara Ribeiro-Parenti · Konstantinos Arapis · Denis Chosidow · Jean-Pierre Marmuse

OBES SURG (2015) 25:215–221

- 1142 patients, 570 antecolic, 572 retrocolic Roux limb
- CSA anastomosis in all patients with 25 mm EEA
- 46 MU
- Symptoms:
  - Dysphagia 50 %
  - Epigastric pain 19 %
  - Bleeding 15 %
  - Nausea / vom. 9 %
  - Perforation 4 %
- Conclusion: retrocolic Roux-limb reduces MU rate

Table 2 Comparison of Roux limb position and marginal ulcer occurrence

	Antecolic group	Retrocolic group	*p* value
Patients (*n*)	572	570	
Marginal ulcer, *n* (%)	32 (5.6)	14 (2.5)	0.007
Perforations, *n* (%)	2 (0.4)	0 (0)	ns

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Early marginal ulcer			
Patients (*n*)	572	570	
Marginal ulcer, *n* (%)	19 (3.3)	8 (1.4)	0.033
Perforations, *n* (%)	1 (0.2)	0 (0)	ns
Late marginal ulcer			
Patients (*n*)	572	570	
Marginal ulcer, *n* (%)	13 (2.3)	6 (1.1)	ns
Perforations, *n* (%)	1 (0.2)	0 (0)	ns

No difference in risk factors (smoking, NSADS, …) between groups

Higher tension on anastomosis in antecolic technique ??

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Prevention of MU

- Avoid risk factors if possible
- Correct modifiable risk factors
- Small pouch
- Retro-colic Roux limb ?
- Technique for GJS ?
- Post-operative PPI therapy
  - 1 month? 3 months? 6months? More?
- Prefer another procedure if no contraindication and risk factors persisting (steroids)

Thank you for your attention