



# Long term laparoscopic Sleeve gastrectomy outcomes

Gerhard Prager

Department of General Surgery

Metabolic and Bariatric Surgery

# Disclosures



unrestricted educational grant  
travel grants



**Medtronic**





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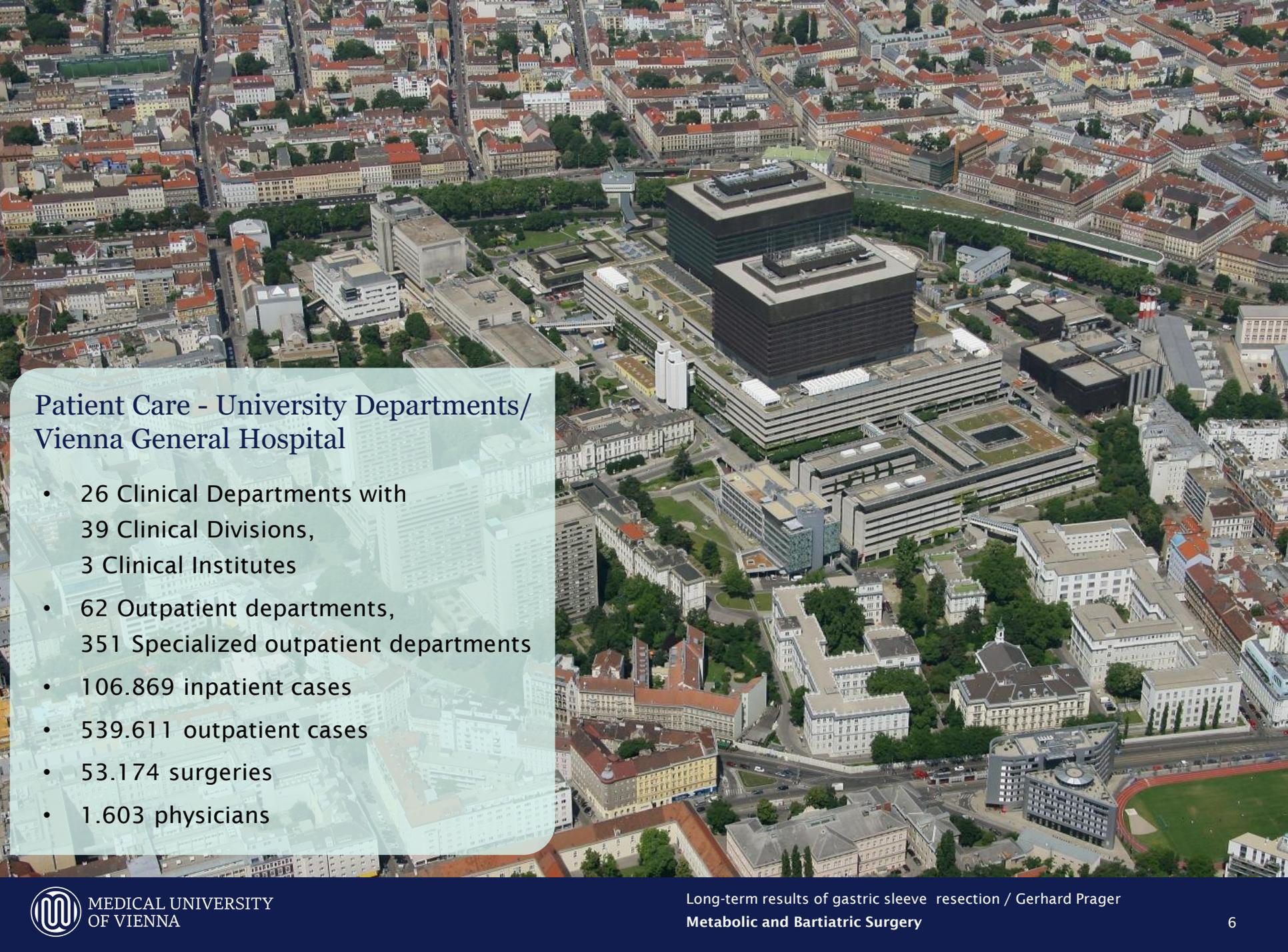
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Long-term results of gastric sleeve resection / Gerhard Prager  
Metabolic and Bariatric Surgery

# The Medical University of Vienna is...

- a medical research and education facility with a tradition spanning over almost **650 years**
- autonomous since 2004 (formerly the “Medical School of the University of Vienna”)
- **Europe’s largest school of medicine** with almost **8,000 enrolled students** located in close vicinity to Europe’s largest hospital (**Vienna General Hospital**), whose **1,500 physicians** it sources
- the employer of more than 5.500 staff members (including 3.600 scientific researchers)





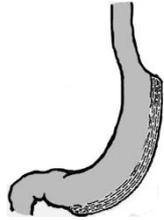
## Patient Care - University Departments/ Vienna General Hospital

- 26 Clinical Departments with  
39 Clinical Divisions,  
3 Clinical Institutes
- 62 Outpatient departments,  
351 Specialized outpatient departments
- 106.869 inpatient cases
- 539.611 outpatient cases
- 53.174 surgeries
- 1.603 physicians

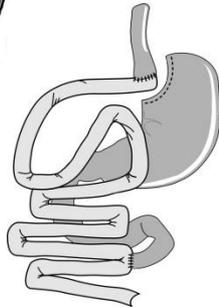




1996 lap. Gastric Banding



2002 lap. Sleeve Gastrectomy



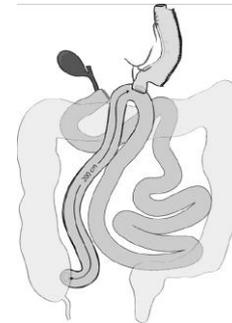
lap. Y-Roux Gastric Bypass



2009 lap. BPD



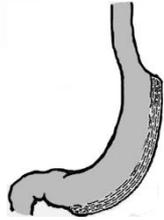
2010 lap. Omega Loop



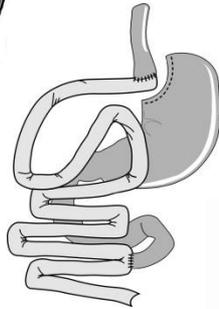
2016 lap SADI-S



lap. Gastric Banding



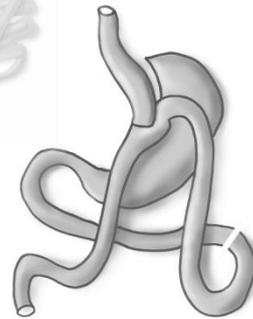
lap. Sleeve Gastrectomy



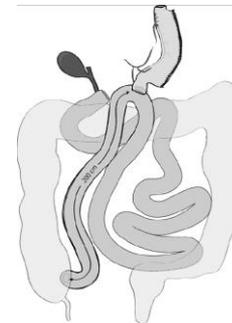
lap. Y-Roux Gastric Bypass



lap. BPD



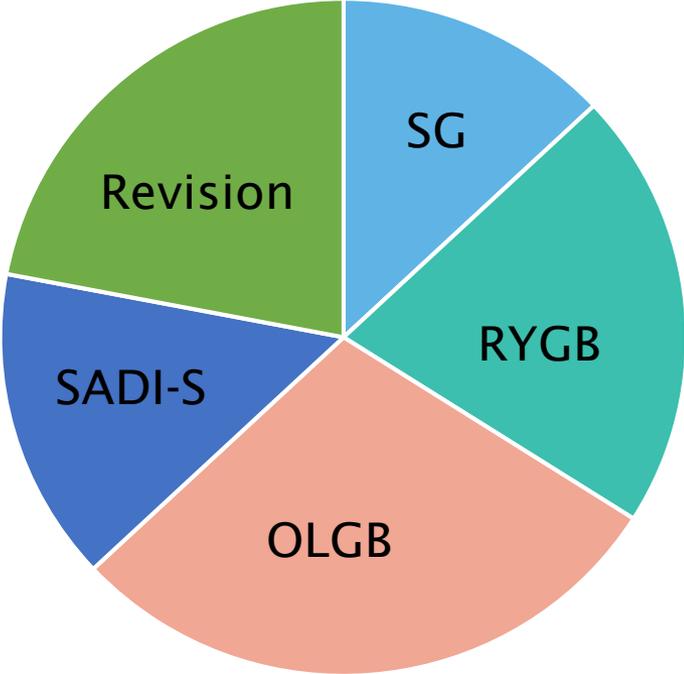
lap. Omega Loop



lap SADI-S

# Disclosures

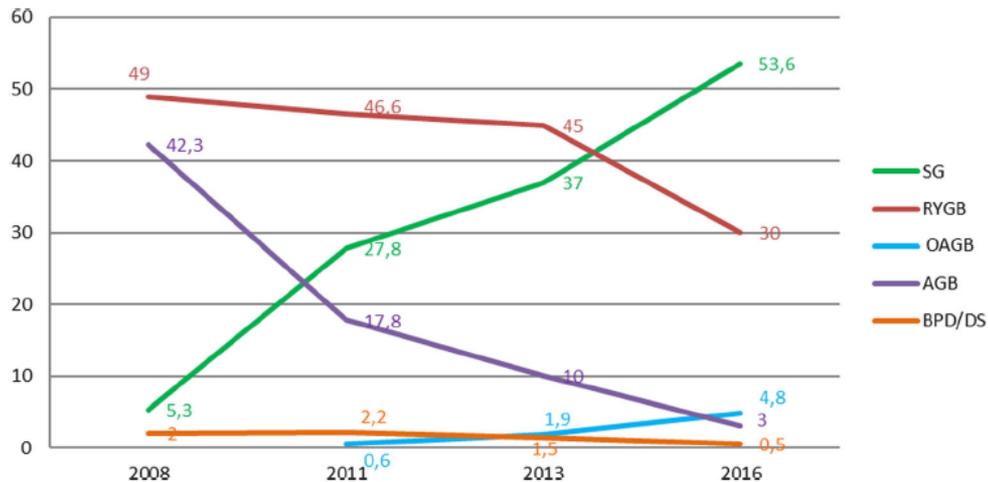
## Case-Mix



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

# Background

Bariatric procedures worldwide 2016:



Procedure	Number
Gastric banding	19.332
<b>Sleeve gastrectomy</b>	<b>340.550</b>
Roux-en-Y GB	191.326
One-anastomosis GB	30.563
BPD/DS	3.346
<b>Total</b>	<b>685.874</b>

Angrisani, Obes Surg 2018

## Bariatric Operations Austria 2015 in %

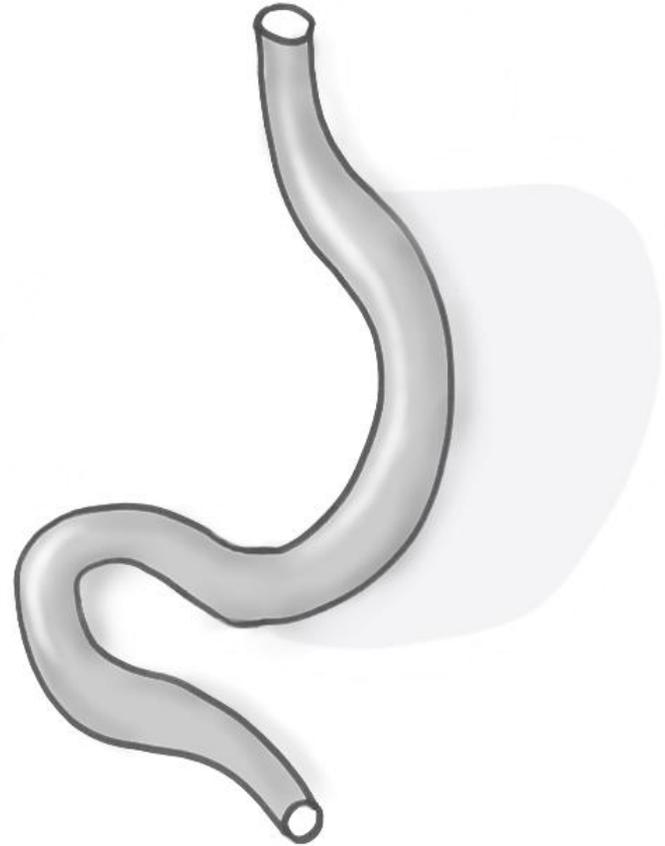


### Operation:

Laparoscopic Gastric Banding	2,0%
<b>Laparoscopic Sleeve Gastrectomy</b>	<b>25,0%</b>
Laparoscopic Y-Roux Bypass	51,0%
Laparoscopic Omega Loop Bypass/OAGB	21,0%
Others	1,0%

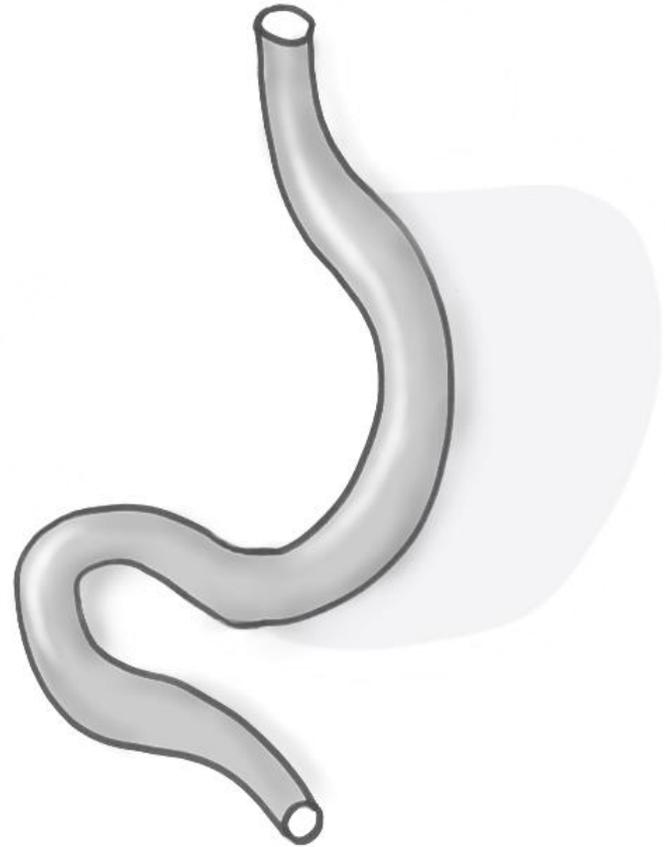
# Long term results

- weight loss/regain
- reflux
- Barrett's Metaplasia
- (impaired) QoL



# Surgical technique comparable?

- > 10years ago?
- today?

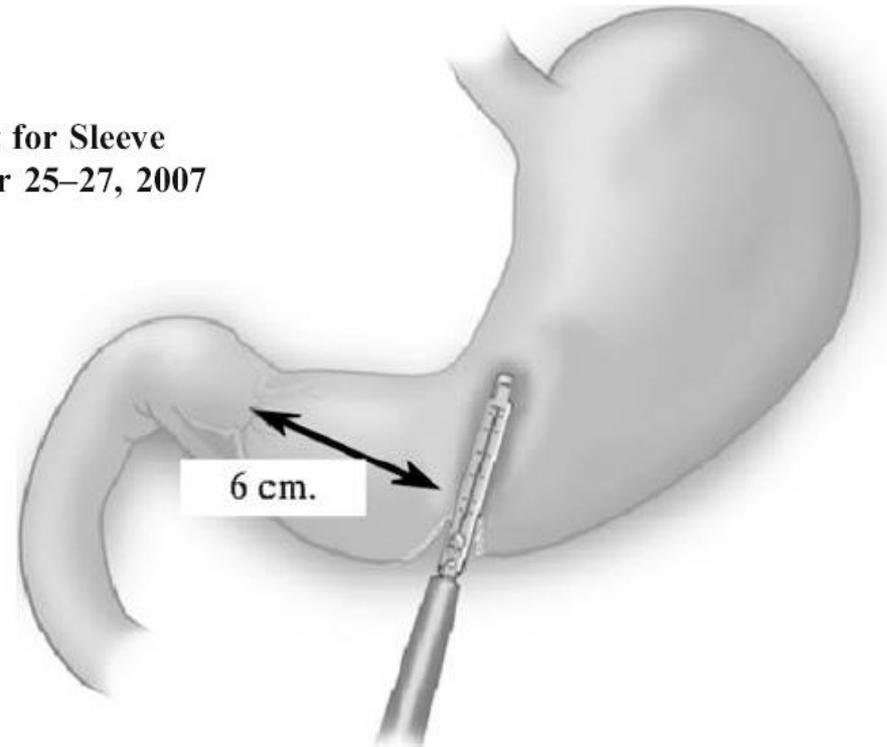


# Surgical technique - 10 years ago



## The First International Consensus Summit for Sleeve Gastrectomy (SG), New York City, October 25–27, 2007

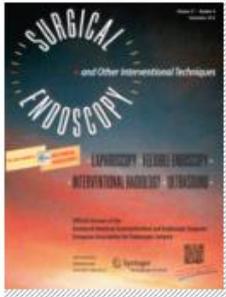
Mervyn Deitel • Ross D. Crosby • Michel Gagner



**Fig. 2** Laparoscopic placement of endoscopic stapler, 6 cm proximal to the pyloric valve (method of Gagner) at approximately the incisura angularis [5]

Deitel et al., Obes Surg 2008

# Surgical technique

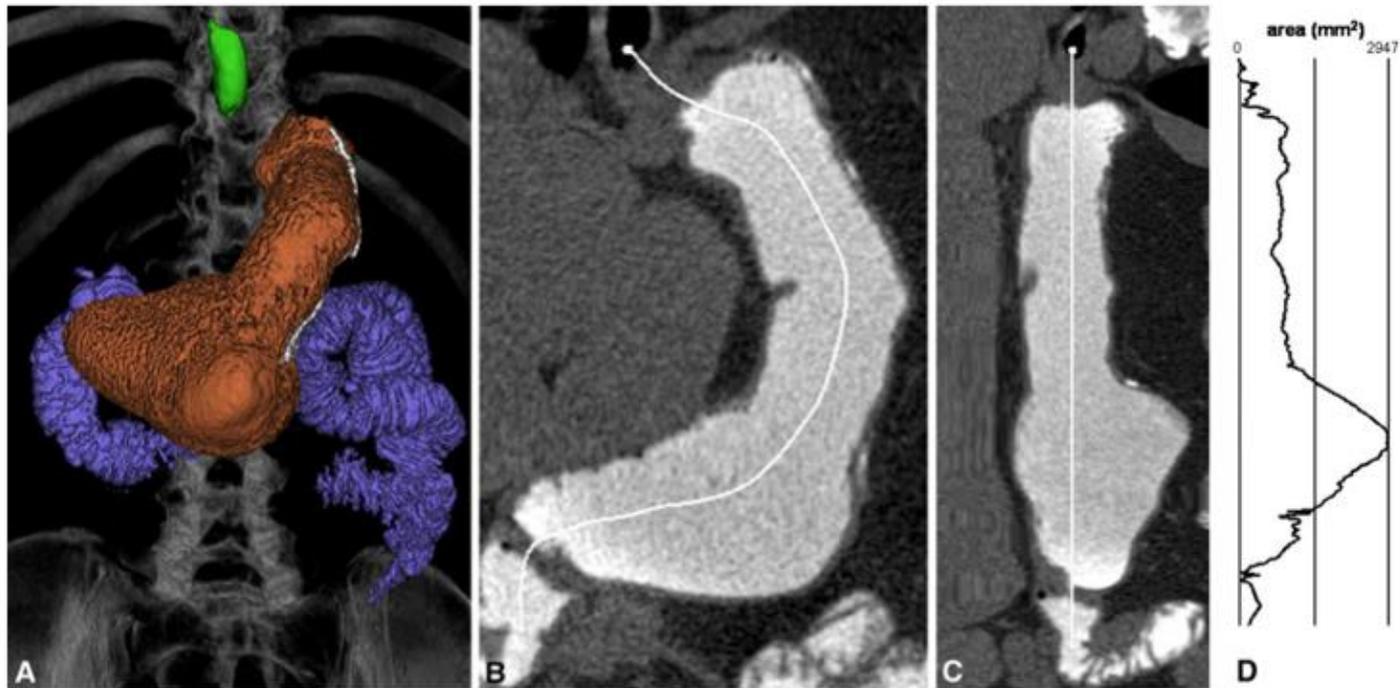


## **Three-dimensional stomach analysis with computed tomography after laparoscopic sleeve gastrectomy: sleeve dilation and thoracic migration**

**Tobias Baumann · Jodok Grueneberger · Gregor Pache · Simon Kuesters · Goran Marjanovic · Birte Kulemann · Philipp Holzner · Iwona Karcz-Socha · Dorothea Suesslin · Ulrich T. Hopt · Mathias Langer · Wojciech K. Karcz**

Baumann T, Surg Endosc 11

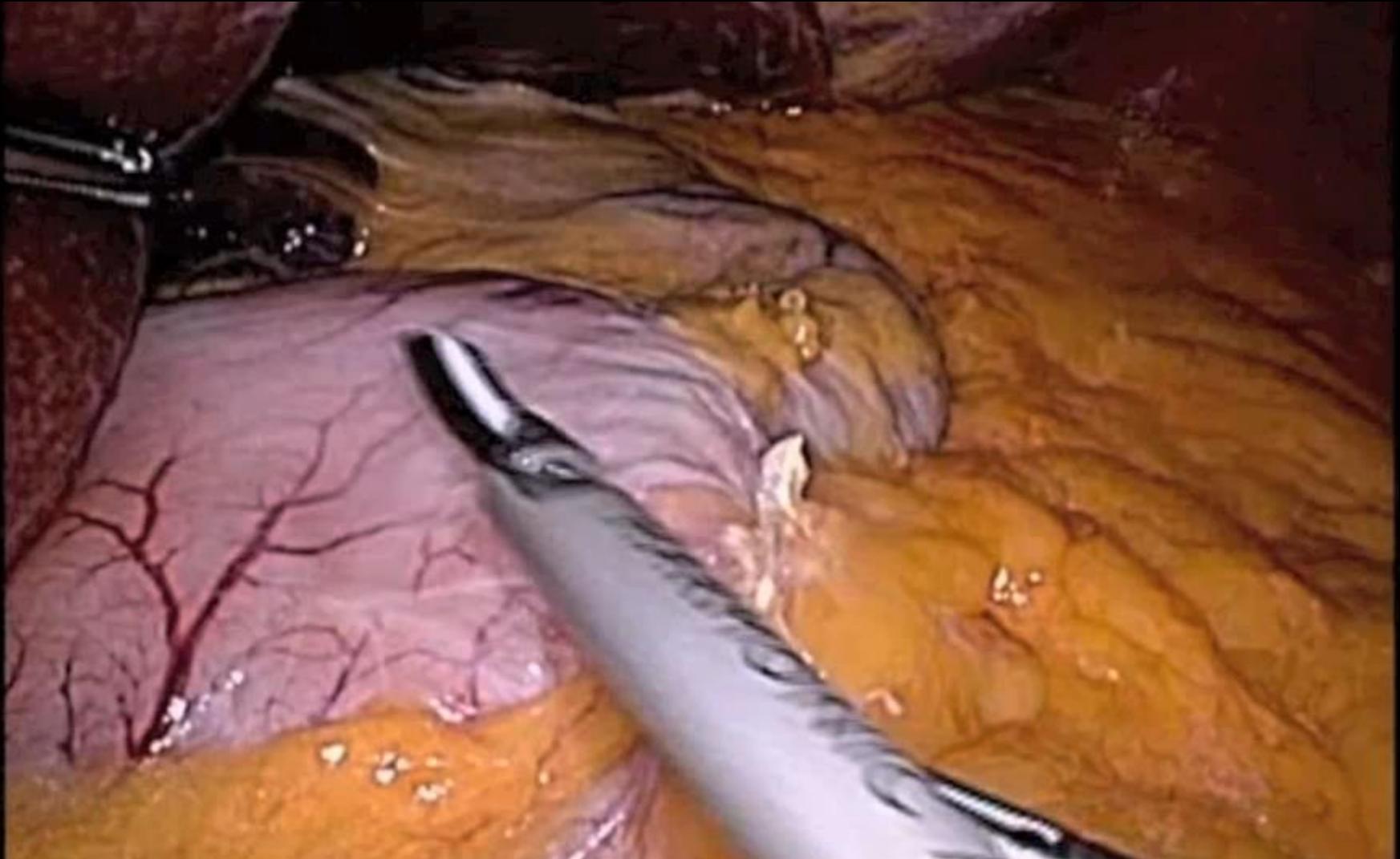
# Surgical technique



**Fig. 1** **A** Volume-rendering image showing an enlarged sleeve stomach with a volume of 330 ml in a 34-year-old female patient 7 months after laparoscopic sleeve gastrectomy. Different transfer functions were applied to each 3D mask to show the stomach (center foreground, *orange* in electronic version), the staple line (left along the stomach, *white* in electronic version), the duodenum and proximal intestine (center background, *blue* in electronic version), and the esophagus (top, *green* in electronic version). The curved planar

reformat along the center of the stomach (**B**) and the stretched view (**C**) show a sleeve with a maximum cross-sectional area of 8.5 cm<sup>2</sup>. This area can be obtained from the automatically generated area profile (**D**). For each position along the same centerline as depicted in (**C**), the cross-sectional area of the stomach is automatically calculated by using a density threshold that identifies the contrast media inside the stomach. The area is given in mm<sup>2</sup>. The maximum value of 2947 mm<sup>2</sup> corresponds to the widest part of the antrum

# Surgical technique – 10 years ago

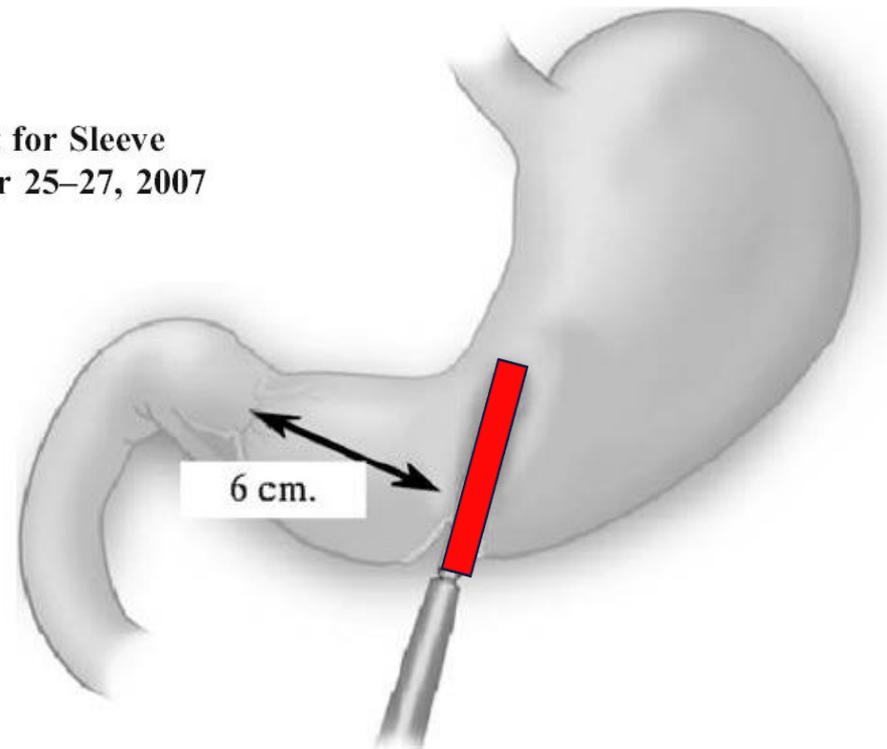


# Surgical technique



## The First International Consensus Summit for Sleeve Gastrectomy (SG), New York City, October 25–27, 2007

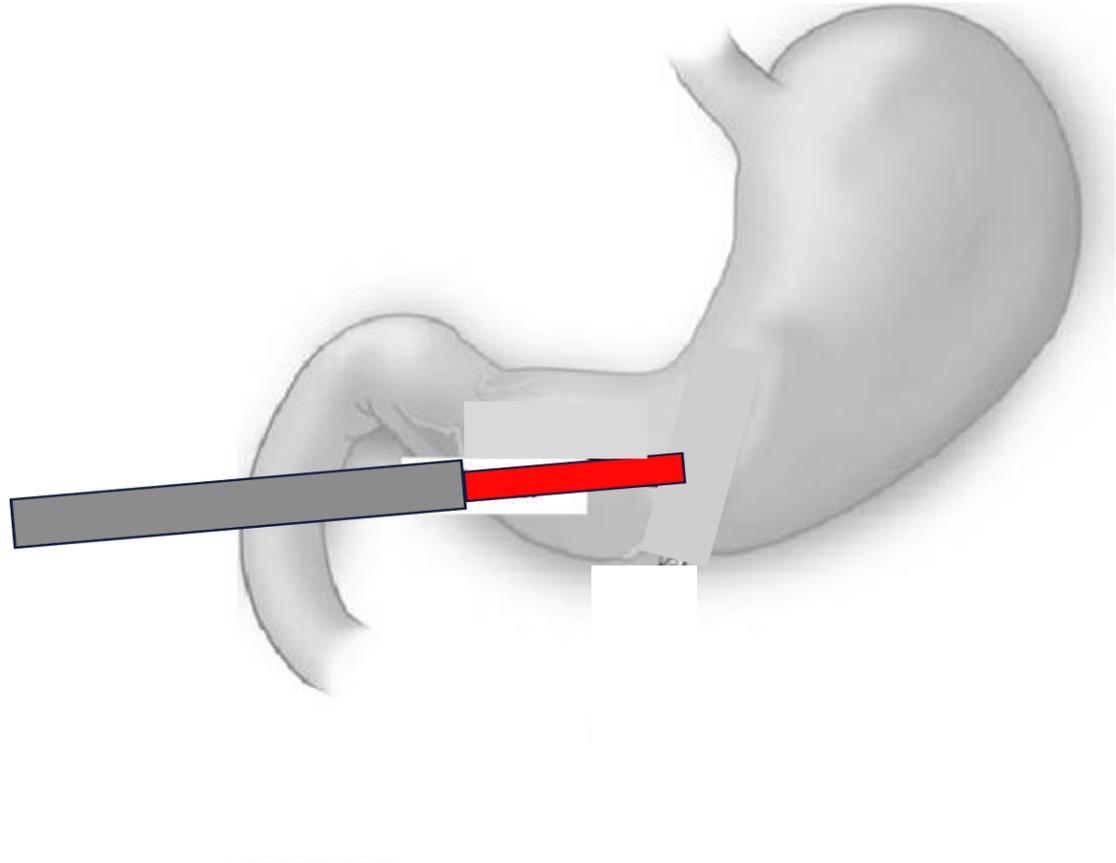
Mervyn Deitel • Ross D. Crosby • Michel Gagner



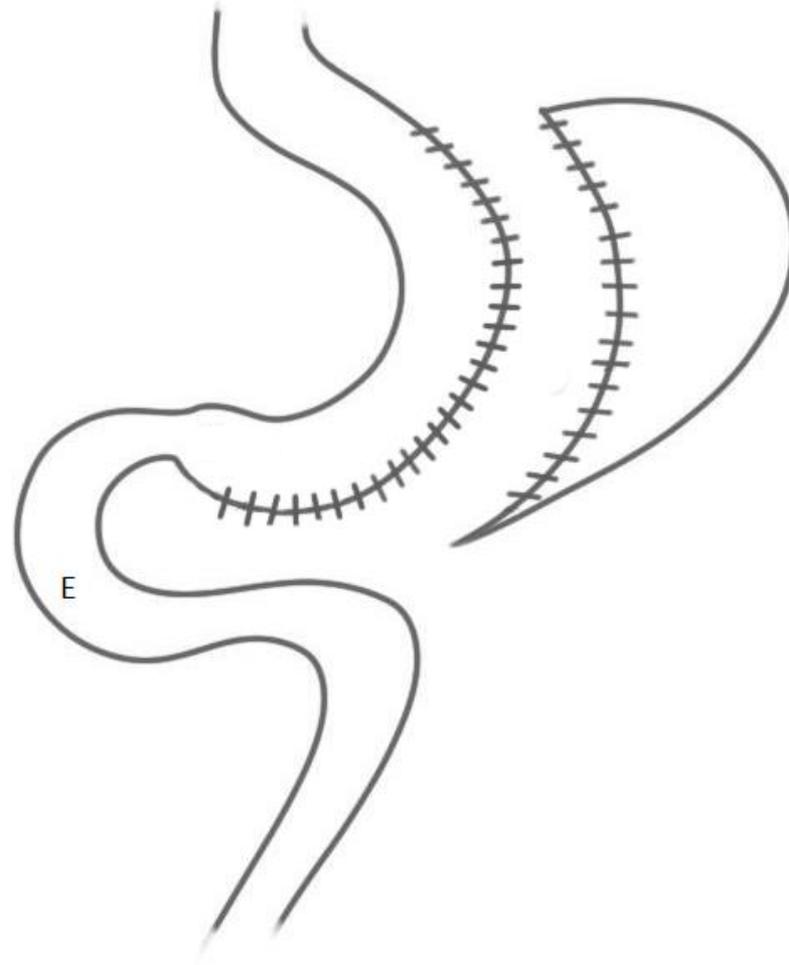
**Fig. 2** Laparoscopic placement of endoscopic stapler, 6 cm proximal to the pyloric valve (method of Gagner) at approximately the incisura angularis [5]

Deitel et al., Obes Surg 2008

# Surgical technique - today

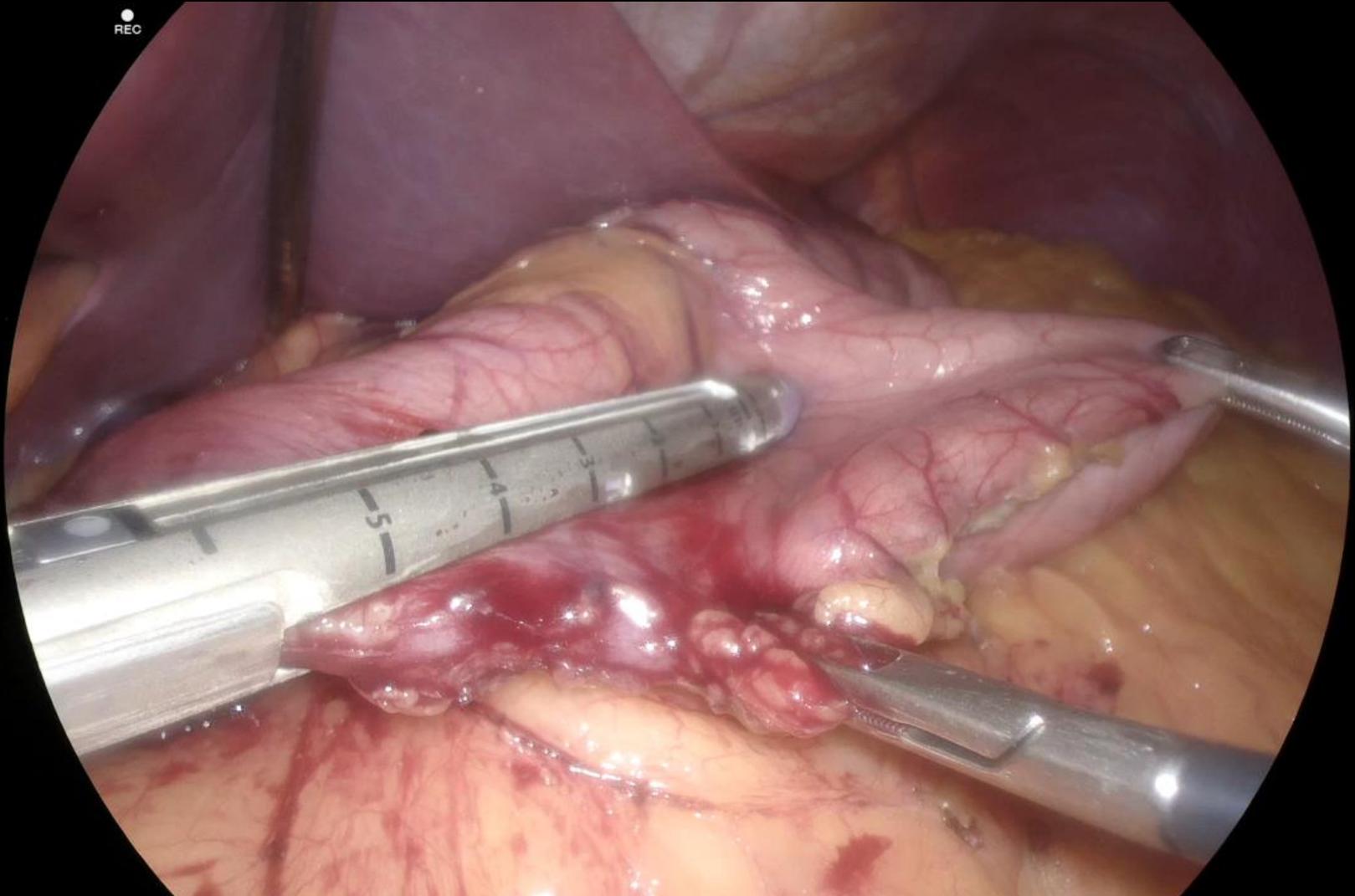


# Surgical technique - today



2017

# Surgical technique



# Antral resection



## Midterm Clinical Outcomes of Antrum Resection Margin at Laparoscopic Sleeve Gastrectomy for Morbid Obesity

Serdar Yormaz<sup>1</sup> · Huseyin Yilmaz<sup>1</sup> · Ilhan Ece<sup>1</sup> · Farise Yilmaz<sup>2</sup> · Mustafa Sahin<sup>1</sup>

Yormaz et al., Obes Surg 2017

# Antral resection



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- |   |             |
|---|-------------|
| A: Antrum resected 2cm from the pylorus | 84 patients |
| B: Antrum resected 6cm from the pylorus | 68 patients |

Yormaz et al., Obes Surg 2017

# Antral resection

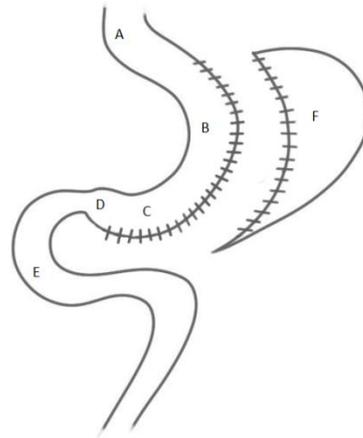


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A: Antrum resected 2cm from the pylorus      84 patients

B: Antrum resected 6cm from the pylorus      68 patients



**better weight loss** (6,12,24 months)

**less short-term GERD** (6,12 months)

Yormaz et al., Obes Surg 2017

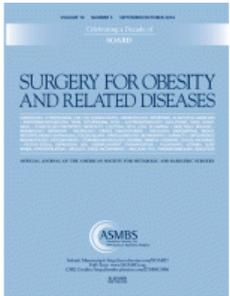
# Antral resection

Review article

## Antral resection versus antral preservation during laparoscopic sleeve gastrectomy for severe obesity: Systematic review and meta-analysis

Emma Rose McGlone, M.B.B.S., M.A., M.R.C.S.<sup>a,\*</sup>, Ajay K. Gupta, M.B.B.S., M.R.C.P., Ph.D.<sup>b,c</sup>,  
Marcus Reddy, M.B.B.S., B.Sc., F.R.C.S.<sup>d,e</sup>, Omar A. Khan, M.B.B.S., Ph.D., F.R.C.S.<sup>d,f</sup>

<sup>a</sup>Department of Metabolic and Investigative Medicine, Hammersmith Hospital Campus, Imperial College London, London, United Kingdom



8 studies (619 participants)

6 randomized controlled trials, 2 cohort studies.

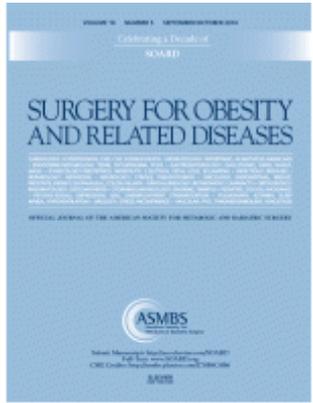
**24-month follow-up:** mean EWL 70% antral resection  
mean EWL 61% antral preservation

no difference: perioperative bleeding  
leak  
de novo gastroesophageal reflux disease

McGlone et al., SOARD 18

# Long term data

# Long term data - literature



## Weight loss, weight regain, and conversions to Roux-en-Y gastric bypass: 10-year results of laparoscopic sleeve gastrectomy

Daniel M. Felsenreich, M.D.<sup>a</sup>, Felix B. Langer, M.D.<sup>a</sup>, Ronald Kefurt, M.D.<sup>a</sup>,  
Peter Panhofer, M.D.<sup>a</sup>, Martin Schermann, M.D.<sup>b</sup>, Philipp Beckerhinn, M.D.<sup>c</sup>,  
Christoph Sperker, M.D.<sup>b</sup>, Gerhard Prager, M.D.<sup>a,\*</sup>

<sup>a</sup>Division of General Surgery, Department of Surgery, Medical University of Vienna, Vienna, Austria

<sup>b</sup>Department of Surgery, Hospital Rudolfstiftung, Vienna, Austria

<sup>c</sup>Department of Surgery, Hospital Hollabrunn, Hollabrunn, Austria

Received October 28, 2015; accepted February 21, 2016

first >10-years data

Complete follow-up

53 patients

Felsenreich DM et al., SOARD 2016

# Long term data – weight loss

Table 4  
Review of the literature on long-term ( ≥5 yr) weight loss of SG

Study	FU	Patients	Bougie size	Nonconverted (n)	%EWL*	Conversion Rate (procedure)
Bohdjalian 2010 [5]	5 yr	26	48Fr	22	55%	15.4% (4 RYGB)
Sieber [7]	5 yr	68	35Fr	60	57%	11.8% (2 RYGB, 6 DS)
Alexandru 2014 [6]	5 yr	30	29Fr	25	56%	16.7% (5 RYGB)
Lemanu 2015 [8]	5 yr	96	38Fr	55	40%	0
Keren 2015 [30]	5 yr	130	n.a.	123	45%	3.1% (7 BPD)
Himpens 2010 [11]	6 yr	53	34Fr	30	53%	24.5% (11 DS, 2 ReS)
D'Hondt 2011 [17]	6 yr	102	30Fr	23	56%	0
Hirth 2015 [18]	7 yr	16	32Fr	14	59 %	0
Eid 2012 [19]	8 yr	126	50Fr	69	46%	40.0% (51 RYGB)
Sarella 2012 [10]	8–9 yr	20	32Fr	13	69%	20.0% (3 RYGB, 1 DS,)
Present study	10 yr	53	48Fr	32	52%	35.8% (18 RYGB, 1 DS)

SG = sleeve gastrectomy; FU = follow up; %EWL = percent excess weight loss; RYGB = Roux-en-Y gastric bypass; DS = duodenal switch; n.a. = not available; BPD = biliopancreatic diversion; ReS resleeve gastrectomy.

\*%EWL of non-converted sleeves at end of follow-up.

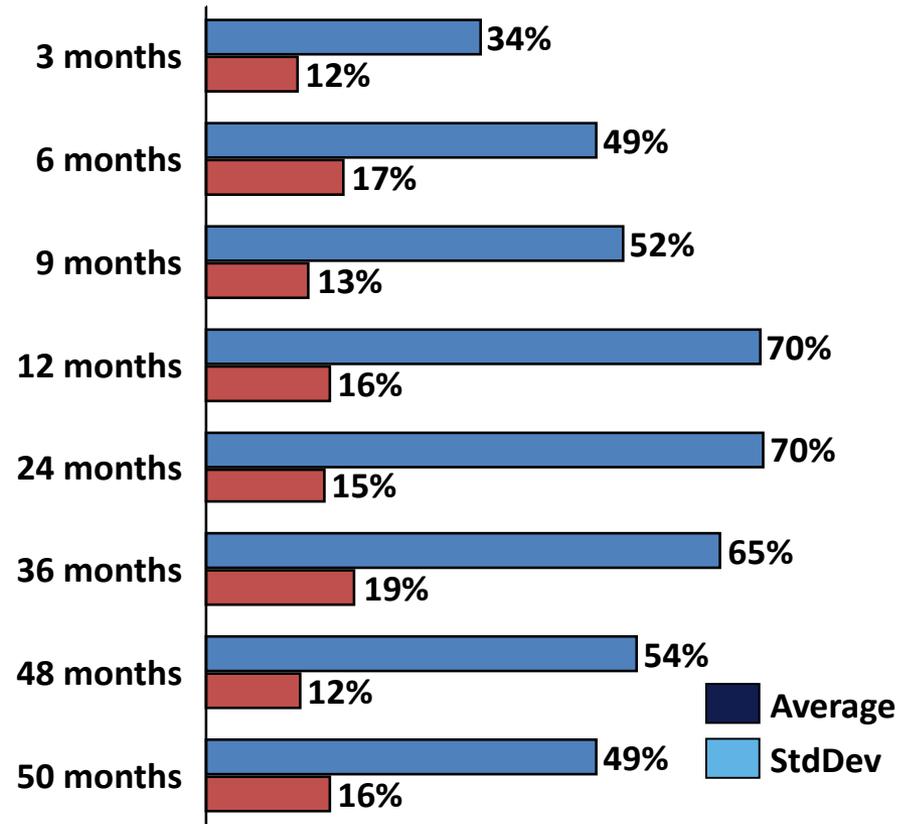
Felsenreich DM et al., SOARD 2016



# Sleeve consensus Miami 2011

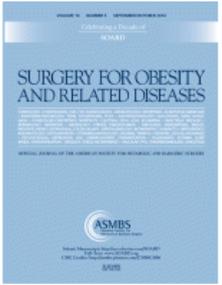
	Average	Std. Deviation
Number of cases	10,544	192
Age	43.1	3.8
Female %	72%	9%
BMI	45.1	3.9
Bougie size	36.5	5.1
Average Hospital Stay	2.4	1
Leak rate	1%	2%
Stricture rate	6%	22%
Rate of Postop GERD	13%	12%
% of Conversions	2%	4%

## Average Weight Loss



**Max. %EWL at 24 months follow-up**

# Long term data



Original article

## Long term (7 or more years) outcomes of the sleeve gastrectomy: a meta-analysis

Benjamin Clapp, M.D., F.A.C.S., F.A.S.M.B.S. \*, Matthew Wynn, Colin Martyn, M.D.,  
Chase Foster, Montana O'Dell, Alan Tyroch, M.D., F.A.C.S.

*Texas Tech University Health Sciences Center El Paso, Paul L. Foster School of Medicine, El Paso, Texas*

Received December 13, 2017; accepted February 28, 2018

Nine cohort studies met the inclusion criteria,  
with a total of **2280 patients included.**

**Only 652 patients had completed  $\geq 7$  years of follow-up.**

Clapp et al., SOARD 2018

# Long term data



Long-term (11+ years) outcomes in weight, patient satisfaction, comorbidities, and gastroesophageal reflux treatment after laparoscopic sleeve gastrectomy

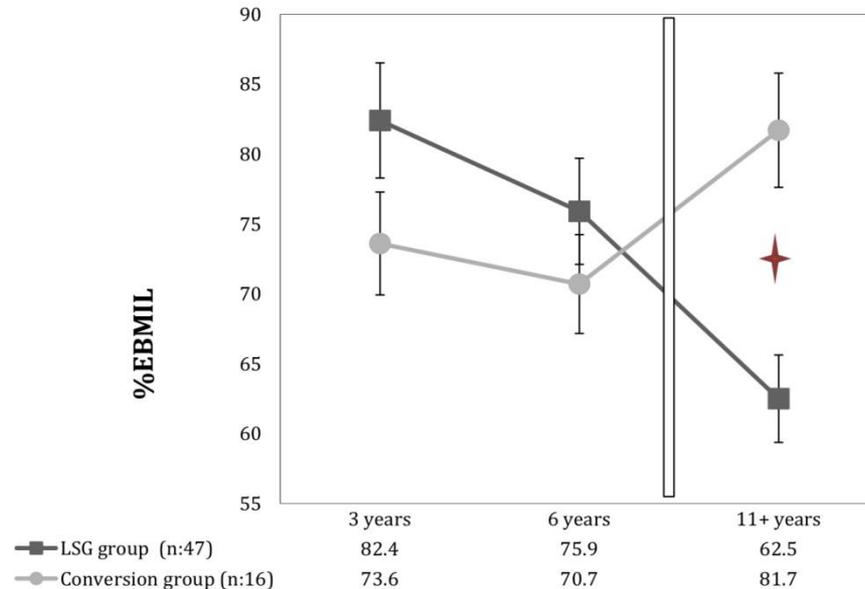
Gustavo A. Arman, M.D.<sup>a,b,\*</sup>, Jacques Himpens, M.D., Ph.D.<sup>a,b</sup>, Jeroen Dhaenens, M.D.<sup>a</sup>, Thierry Ballet, M.D.<sup>b</sup>, Ramon Vilallonga, M.D., Ph.D.<sup>a</sup>, Guido Leman, M.D.<sup>a</sup>

<sup>a</sup>Division of Bariatric Surgery, AZ St-Blasius, Dendermonde, Belgium

<sup>b</sup>Cavell Obesity Center, CHIREC, Brussels, Belgium

110 consecutive patients,  
complete **follow-up 59.1%**

**Reoperations:  
20 patients (31.7%)**



Arman et al., SOARD 16

# Long-term studies

Study / Author	Year	Nr. patients	Mean follow-up (years)	Conversion (%)	Weight loss (%EWL)	Reflux (%)	Barrett (%)	ΔBMI Kg/m <sup>2</sup>
Noel	2017	168	8.0	16.6	67.0	31.0	N/A	11.4
Kowalewsky	2018	100	8.0	16.0	51.1	56.0	N/A	12.1
Mandeville	2017	100	8.5	29.5	60.8	47.8	N/A	9.1
Sarela	2012	20	8.0-9.0	20.0	68.0	35.0	N/A	14.0
Gissey	2018	144	10.0	2.0	52.5	24.0	N/A	15.1
Chang	2018	65	10.0	16.9	70.5	50.0	N/A	10.9
Felsenreich	2018	103	11.0	33.0	50.0	57.0	14.0	13.5
Arman	2016	110	11.7	25.0	62.5	21.4	N/A	10.1

# Our Data

Obesity Surgery

<https://doi.org/10.1007/s11695-018-3399-1>



ORIGINAL CONTRIBUTIONS



## Update: 10 Years of Sleeve Gastrectomy—the First 103 Patients

Daniel M. Felsenreich<sup>1</sup> • Lukas M. Ladinig<sup>1</sup> • Philipp Beckerhinn<sup>2</sup> • Christoph Sperker<sup>3</sup> • Katrin Schwameis<sup>1</sup> • Michael Krebs<sup>4</sup> • Julia Jedamzik<sup>1</sup> • Magdalena Eilenberg<sup>1</sup> • Christoph Bichler • Gerhard Prager<sup>1</sup>  • Felix B. Langer<sup>1</sup>

**100% Follow-up**

Felsenreich et al., Obesity Surgery 2018

# Design – Our Data

Multicenter cross-sectional study:

Deadline: Dec. 31, 2006 → minimal follow-up of 10 years

Criterion for inclusion: lap. sleeve gastrectomy

Number of patients	103		
Age at the time of surgery	38.8 (15-74) years		
Sex	<i>male</i>	25 (25.0%)	
	<i>female</i>	77 (75.0%)	
Weight at the time of surgery	<b>140.1</b>	± 27.9 kg	(100 - 230)
BMI at the time of surgery	<b>49.0</b>	± 9.1 kg/m <sup>2</sup>	(40 - 90)

Felsenreich et al., Obesity Surgery 2018

Multicenter-cross-sectional-study:

Deadline: 31.12.2006 → minimal follow-up of 10 years

Criterion for inclusion: lap. sleeve gastrectomy

Follow up on weight Loss: **100%!!!**

**All** patients had gastroscopy and biopsy of the GE junction before surgery

Contraindication for Sleeve were:

**Hiatal hernia**

**Reflux**

**Barrett`s metaplasia**

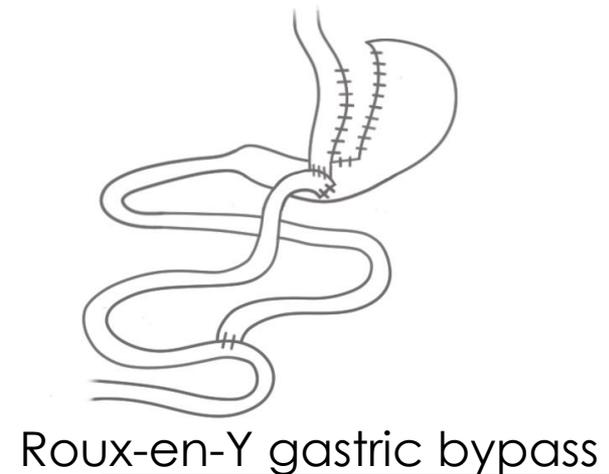
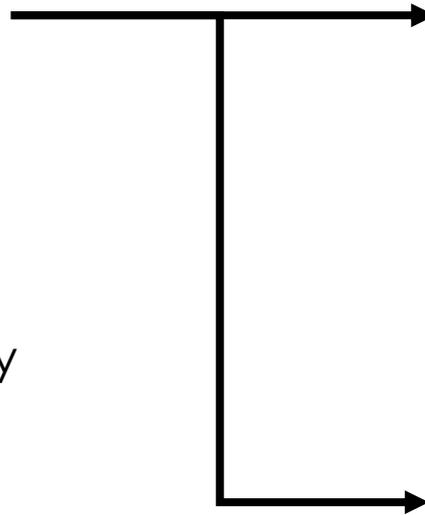
# METABOLIC & BARIATIC Surgery

University Clinic for General Surgery – AKH Vienna



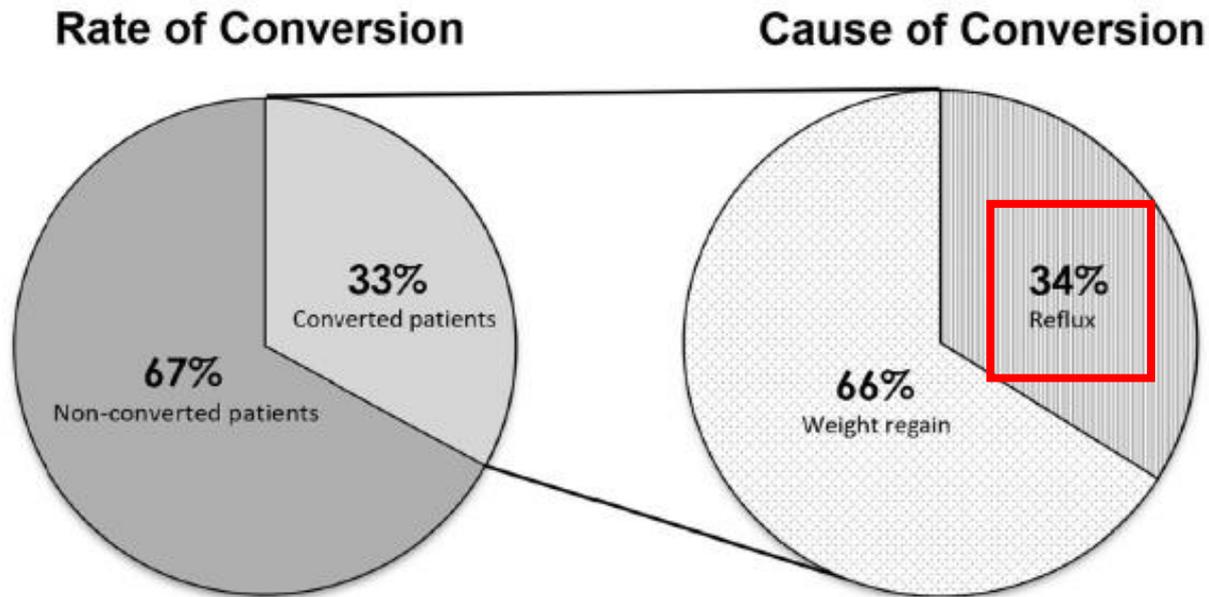
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10 years follow-up:



# Conversion – Our Data

10 years follow-up:



Felsenreich et al., Obesity Surgery 2018

# METABOLIC & BARIATIC Surgery

University Clinic for General Surgery – AKH Vienna



DEPARTMENT OF SURGERY  
MEDICAL UNIVERSITY OF VIENNA

	Total (n=96)*	Not converted (n=65)*	Converted (n=31)*
<b>Weight (surgery)</b>	<b>139.9 ±28.3</b>	138.7 ±25.0	142.4 ±31.8
BMI	48.9 ±9.3	48.7 ±9.0	49.4 ±9.4

# METABOLIC & BARIATIC Surgery

University Clinic for General Surgery – AKH Vienna



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BMI	48.9 ±9.3	48.7 ±9.0	49.4 ±9.4
<b>Weight (nadir)</b>	91.6 ±22.9	86.4 ±18.1	100.4 ±27.4
BMI	32.3 ±7.2	30.9 ±6.2	34.2 ±8.0
EWL (%)	<b>68.1 ±24.5</b>	74.30 ±19.1	64.5 ±31,8

# METABOLIC & BARIATIC Surgery

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EWL (%)	68.1 ±24.5	74.30 ±19.1	64.5 ±31,8
<b>Weight (conversion)</b>			<b>121.5 ±28.2</b>
BMI			41.7 ±8.3
EWL (%)			<b>27.1 ±31.3</b>

\* Dead (n=4) and acute converted (n=3) patients removed



# METABOLIC & BARIATIC Surgery

University Clinic for General Surgery – AKH Vienna



DEPARTMENT OF SURGERY  
MEDICAL UNIVERSITY OF VIENNA

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<b>Weight (conversion)</b>			121.5 ±28.2
BMI			41.7 ±8.3
EWL (%)			27.1 ±31.3
<b>Weight (current)</b>	<b>98.4 ±25.2</b>	97.0 ±26.8	100.7 ±22.5
BMI	35.5 ±7.1	35.9 ±7.3	34.9 ±7.0
EWL (%)	<b>53.2 ±25.1</b>	51.6 ±23.1	55.7 ±28.3

\* Dead (n=4) and acute converted (n=3) patients removed



# EWL - Our Data

10 years Follow-Up:

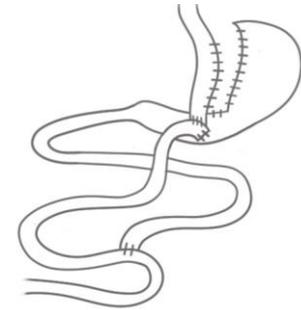
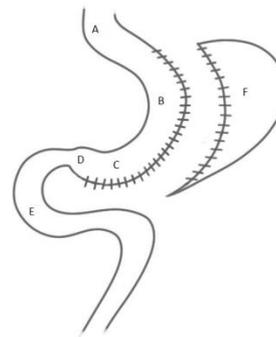


Table 1 Patient characteristics and history of weight

	All patients* (n = 97)	Non-conversion* (n = 65) 67%	Conversion* (n = 32) 33%	
			Weight regain (n = 21)	Reflux (n = 11)
10 years				
Weight (Today) in kg	99.3 ± 21.5	99.6 ± 20.7	101.5 ± 23.8	96.2 ± 22.3
BMI (Today) in kg/m <sup>2</sup>	35.1 ± 7.1	35.5 ± 6.7	35.2 ± 8.2	33.8 ± 6.8
Change BMI (kg/m <sup>2</sup> )	14.0 ± 8.6	13.3 ± 8.5	16.1 ± 10.3	13.5 ± 5.1
EWL (Today) in %	52.5 ± 24.9	50.0 ± 22.5	55.5 ± 32.4	57.1 ± 21.0
TWL (%)	28.2 ± 13.9	26.2 ± 12.7	31.5 ± 17.0	30.7 ± 13.6
Median post OP time (months)	132.1	131.8	133.0	145.2

SG Sleeve Gastrectomy, BMI Body Mass Index, EWL Excess Weight Loss, TWL Total Weight Loss, OP Operation

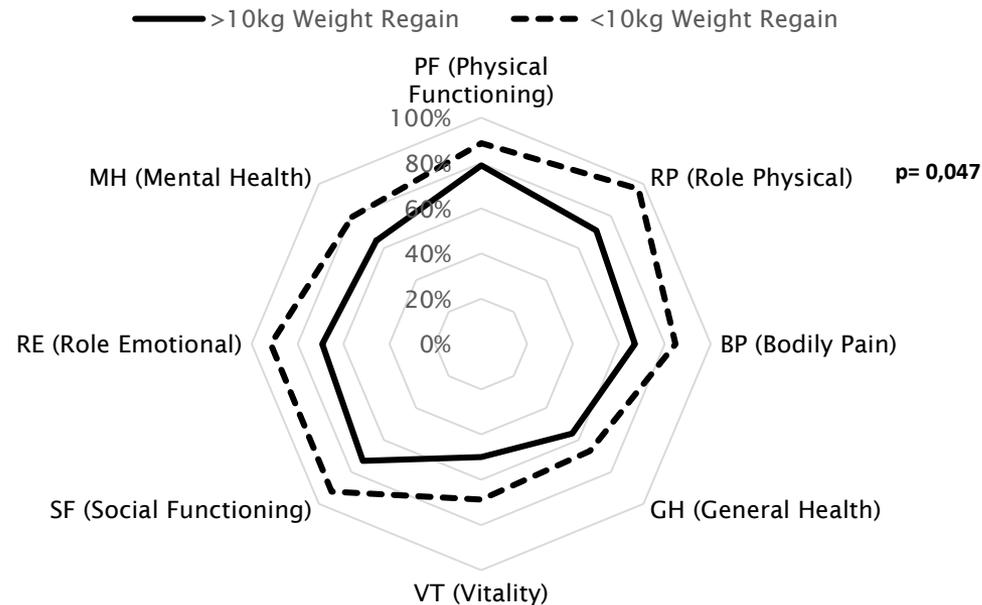
\*Four deceased patients and two acutely converted patients were removed from this calculation

Felsenreich et al., Obes. Surg. 2018



# Long term data – QoL +/- weight regain

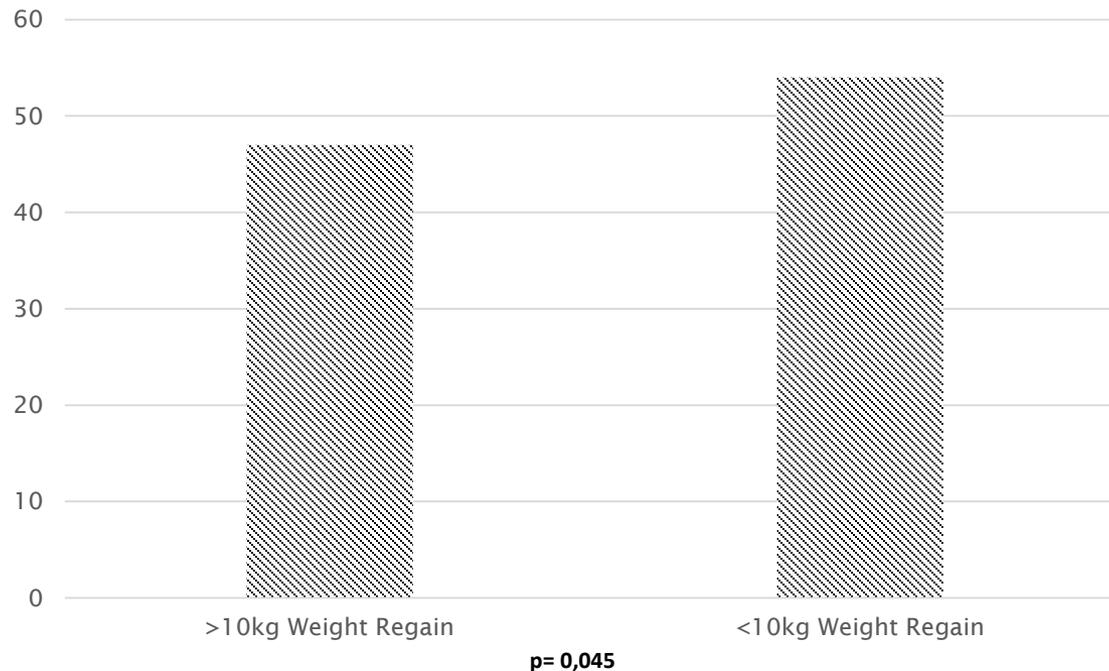
SF36 in patients >10kg and <10kg Weight Regain



Felsenreich DM et al., unpublished data

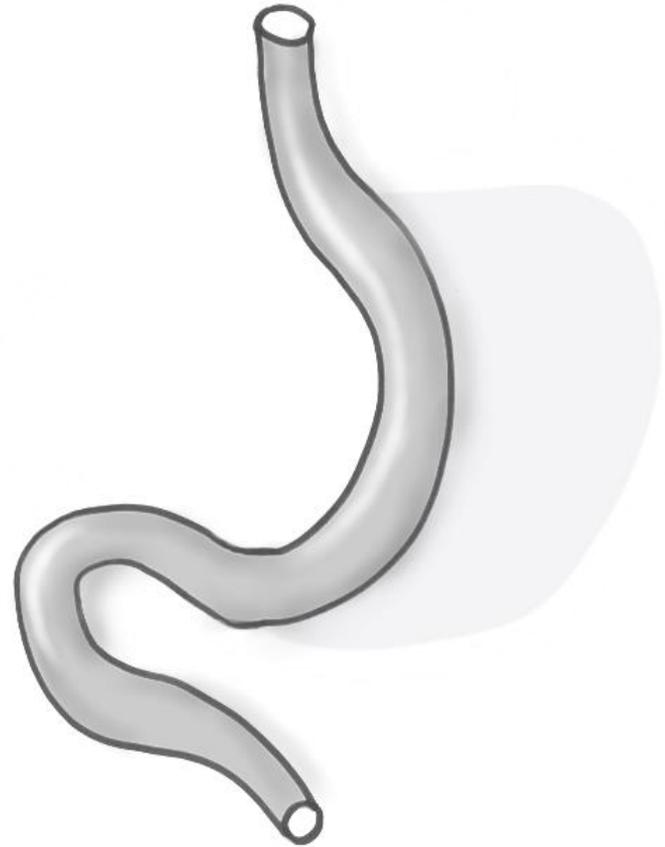
# Long term data – QoL +/- weight regain

BQL in patients >10kg and <10kg Weight Regain



Felsenreich DM et al., unpublished data

# Long term data – endoscopy



# METABOLIC & BARIATIC Surgery

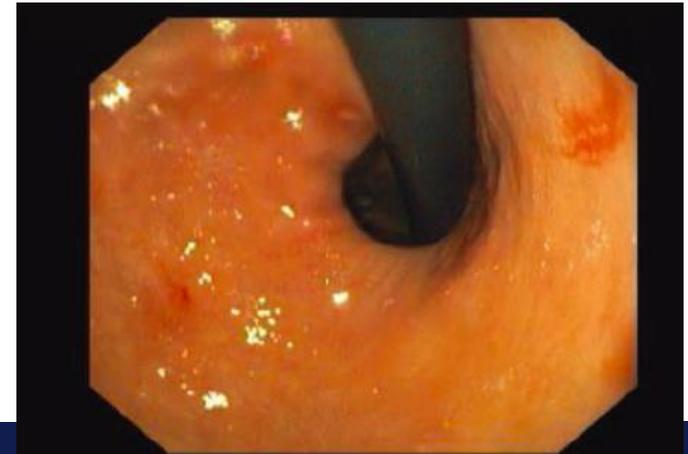
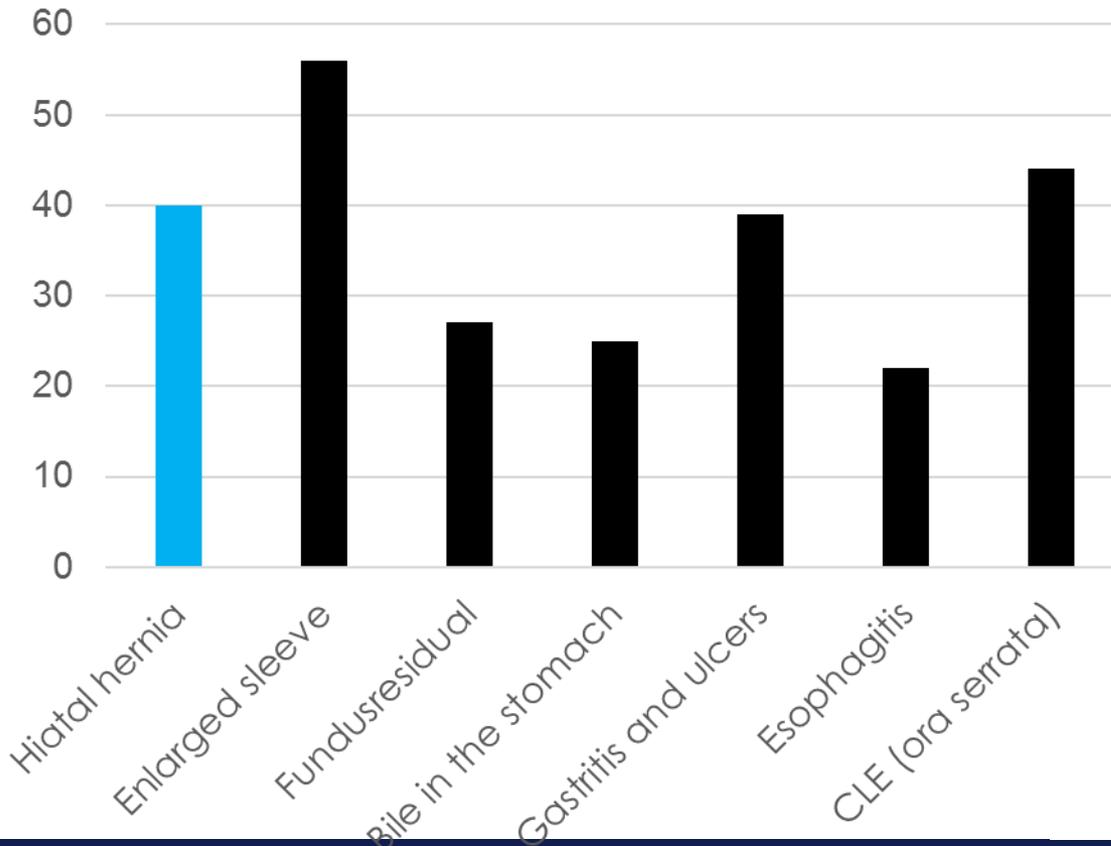
University Clinic for General Surgery – AKH Vienna



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Sleeve not converted n=50

## Gastroscopy macroscopic (%)



# METABOLIC & BARIATIC Surgery

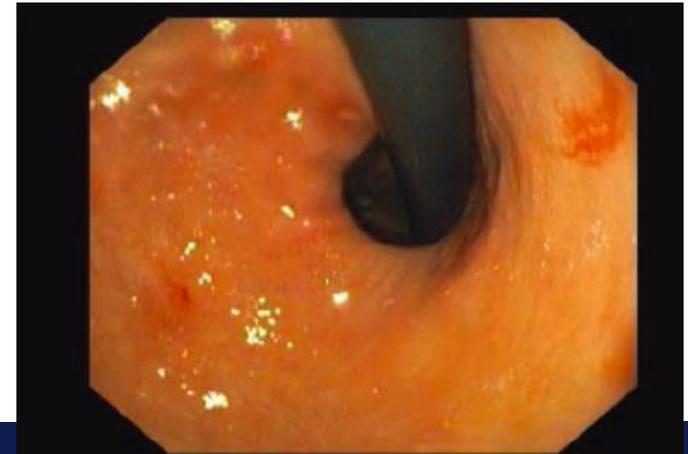
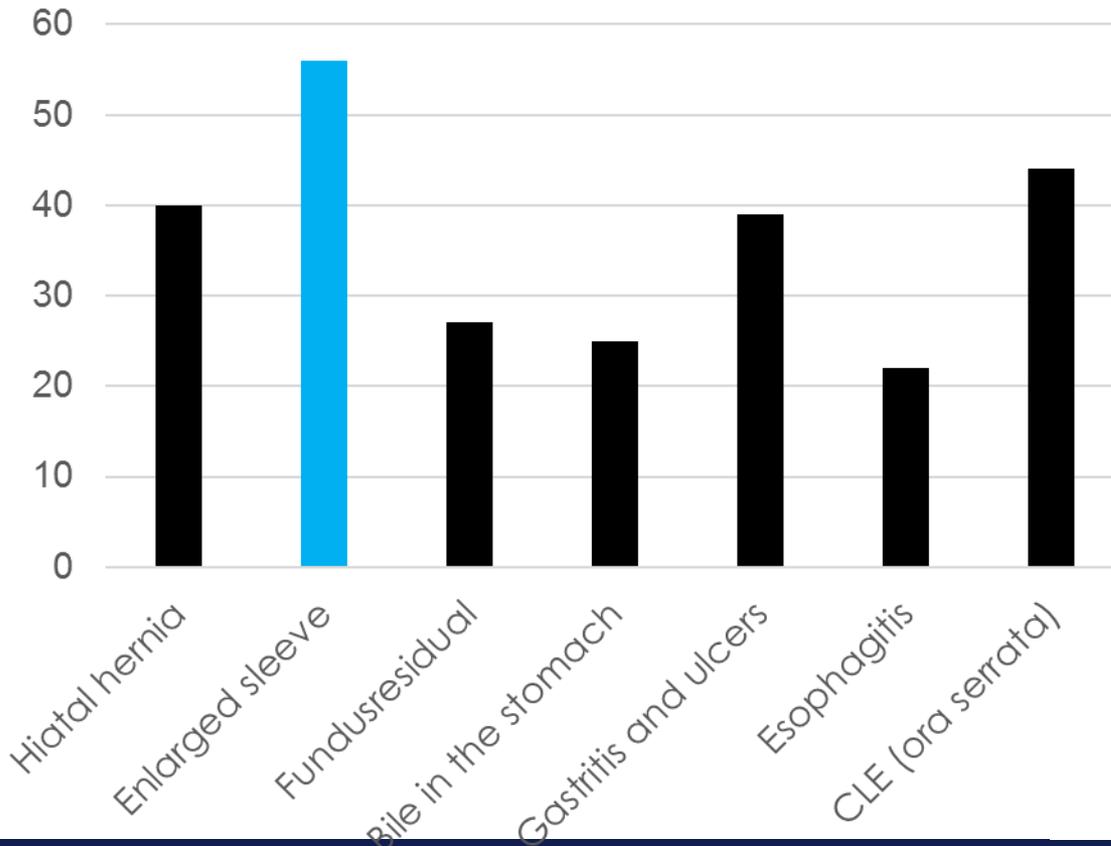
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Sleeve not converted n=50

## Gastroscopy macroscopic (%)



# METABOLIC & BARIATIC Surgery

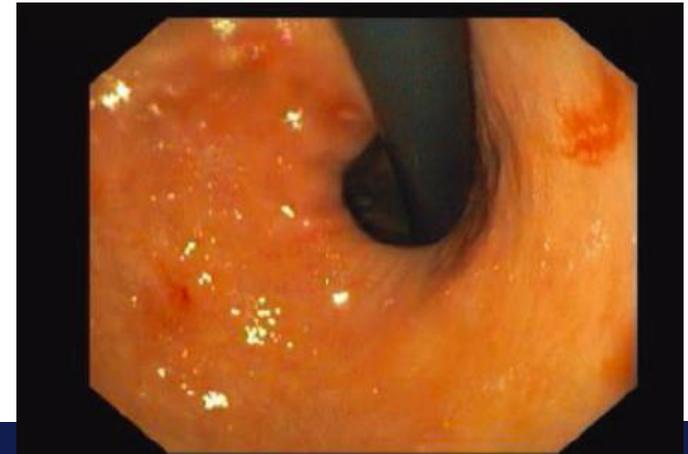
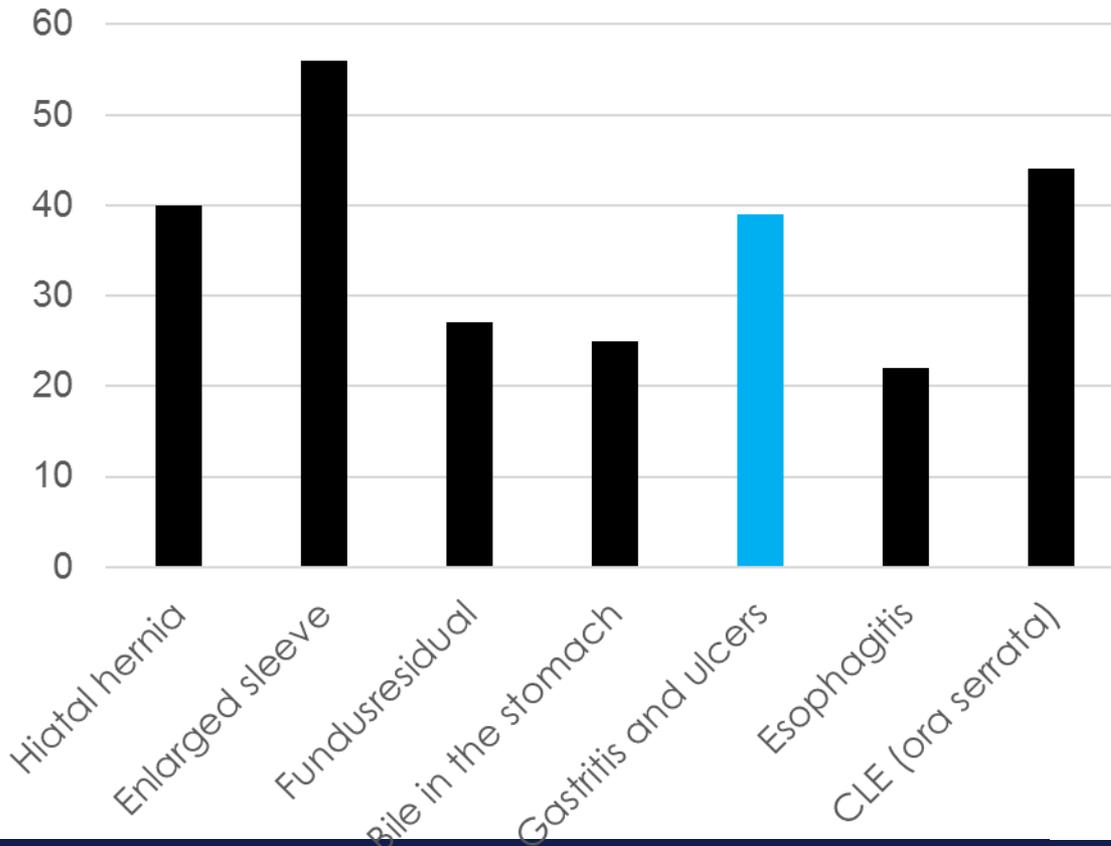
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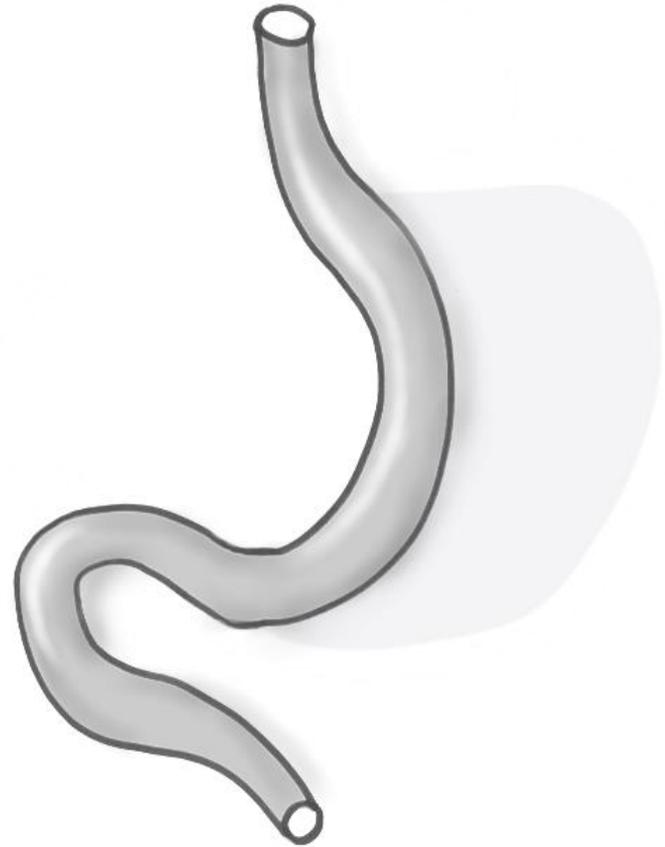
Sleeve not converted n=50

## Gastroscopy macroscopic (%)



# Long term complications

- Weight regain
- Reflux
- Barrett
- QoL



# Reflux

Short-term studies:



(decrease)

Mid-term studies:



Long-term studies:



(increase)

# Long term data – reflux



Surgery for Obesity and Related Diseases 10 (2014) 243–249

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

## Outcome of sleeve gastrectomy as a primary bariatric procedure

P. W. J. van Rutte, J. F. Smulders, J. P. de Zoete and S. W. Nienhuijs

Department of Surgery, Academic Hospital, PO Box 1100, 5602 ZA, Eindhoven, The Netherlands  
Correspondence to: P. W. J. van Rutte (e-mail: r.w.vanrutte@isg.umc.nl)

**Background:** would be outcome. **Methods:** institution online data 1 year we procedure. **Results:** duration: 1 in 27 pati 1 year of cent after patients. **Conclusion:** Paper accepted.

OBES SURG  
DOI 10.1007/s11695-015-1177-0

### ORIGINAL CONTRIBUTIONS

## The Effect of Laparoscopic Sleeve Gastrectomy with Concomitant Hiatal Hernia Repair on Gastroesophageal Reflux Disease in the Morbidly Obese

Kanran Samakir<sup>1</sup> · Travis J. McKenzie<sup>2</sup> · Ali Tavakkoli<sup>3</sup> · Ashley H. Vernon<sup>4</sup> · Malcolm K. Robinson<sup>5</sup> · Scott A. Shikora<sup>6</sup>

© Springer Science+Business Media New York 2015

### Abstract

**Background:** The effect of laparoscopic sleeve gastrectomy (LSG) on gastroesophageal reflux disease (GERD) is controversial. Although concomitant hiatal hernia repair (HHR) at the time of LSG is common and advocated by many, there are few data on the outcomes of GERD symptoms in these patients. The aim of this study was to evaluate the effect of concomitant HHR on GERD symptoms in morbidly obese patients undergoing LSG.

**Methods:** A single institution, multi-center, prospective study maintained database was examined to identify patients who underwent LSG and concomitant HHR from December 2010 to October 2013. Patient characteristics, operative details, and postoperative outcomes were analyzed. Standardized patient questionnaires administered both pre- and postoperatively were utilized. Primary endpoints included subjective reflux symptoms and the need for antireflux therapy. Weight loss was considered a secondary endpoint.

**Results:** Fifty-eight patients were identified meeting inclusion criteria (LSG+HHR), with a mean follow-up of 97.5 weeks (range 44–172 weeks). The mean age of the cohort was 49.5±11.2 years, with 74.1% being female. Mean preoperative BMI was 44.2±6.6 kg/m<sup>2</sup>. Preoperative upper gastrointestinal contrast series was performed in all patients and demonstrated a hiatal hernia in 34.5% of patients and reflux in 15.5% of patients. Postoperatively, 34.6% (n=26) of patients reported subjective symptoms of reflux and/or required daily antireflux therapy. After LSG+HHR, 34.6% of symptomatic patients had resolution of their symptoms of reflux while the rest remained symptomatic and required daily antireflux therapy; 84.4% of patients that were asymptomatic preoperatively remained asymptomatic after surgery. New onset reflux symptoms requiring daily antireflux therapy was seen in 15.6% of patients who were previously asymptomatic. Post surgical weight loss did not correlate with the presence or resolution of reflux symptoms.

**Conclusion:** Based on our data, LSG with concomitant HHR improved GERD symptoms or the need for daily antireflux therapy only in a third of symptomatic patients. Furthermore, 15.6% of asymptomatic patients developed de novo GERD symptoms despite a HHR. In patients with a documented hiatal hernia, HHR does not lead to GERD resolution or prevention after LSG, indicating the need for appropriate patient

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OBES SURG (2015) 22:1874–1879  
DOI 10.1007/s11695-015-0746-6

### CLINICAL RESEARCH

## Laparoscopic Sleeve Gastrectomy: Symptoms of Gastroesophageal Reflux can be Reduced by Changes in Surgical Technique

Jorge Diaz · Manuel E. Jimenez · Nadin Said · Juan C. Daza · Rodolfo Demis

Published online: 23 August 2012  
© The Author(s) 2012. This article is published with open access at Springerlink.com

**Abstract** Background Bariatric surgery is the most effective treatment for gastro-esophageal reflux disease (GERD) in obese patients, with the Roux-en-Y gastric bypass being the technique preferred by many surgeons. Published data reporting the results of laparoscopic sleeve gastrectomy (LSG) in patients with GERD are contradictory. In a previous observational study, we found that relative narrowing of the distal sleeve, hiatal hernia (HH), and dilation of the fundus pre-

### UPPER GI

## Laparoscopic sleeve gastrectomy: review of 500 cases in single surgeon Australian practice

Simon C. Gibson, Philip A. Le Page and Craig J. Taylor  
Iliac Surgery, Concord Hospital, Sydney, New South Wales, Australia

**Key words:** bariatric surgery, gastroscopy, laparoscopic surgery, obesity, sleeve gastrectomy.

**Correspondence:** Philip A. Le Page, GCCHS, 21 Gillies Street, Crows Nest, NSW 2065, Australia.  
e-mail: cpage@iiloo.com.au

© October 2013.

### Introduction

Laparoscopic sleeve gastrectomy (LSG) has been developed as an alternative bariatric operation associated with low rates and satisfactory complication rates when performed by experienced hands.<sup>1,2</sup> Meta-analysis and systematic review of the procedure.

The supposed simplicity of the procedure, its low cost, and its low mortality have led to its widespread use. The procedure has been used as the form of staple line leaks, reintervention, esophageal reflux disease (GERD) and rarely in high-risk groups.<sup>3,4,5,6,7</sup> The long-term

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### Abstract

**Introduction:** Reported results and techniques of laparoscopic sleeve gastrectomy (LSG) are variable. Our objective was to assess results of weight loss in a large consecutive series of LSG, describing its contribution to outcomes.

**Methods:** Retrospective review of prospectively collected data on patients undergoing LSG. Patient demographics, weight loss, or total outcomes were analyzed and operative technique described. **Results:** Five hundred patients underwent LSG over 5 years; preoperative body mass index was 45 kg/m<sup>2</sup> (35–76 kg of length of hospital stay were 14 months (1–34) and 3.8 day (range 30-day readmission rate 1.2%. Mean excess weight to maintain patient data was 0.9% (22–65%, 423 patients), 50% (4.6% (52–84%, 258 patients), 71% (51–87%, 102 patients) at 1, 2, and 3 months, respectively. There was no mortality or major complications in two (0.4%) – splenic bleeding, biliary injury. Early surgical complications in four (1.2%) patients (for one post-operative Needs). Other early complications occurred (one pseudomonas pneumonia, one central line sepsis, one pneumonia) and late in four (0.8%) patients (three port-site or suture structure requiring endoscopic dilatation). Gastroesophageal reflux disease (GERD) occurred in four (1.2%) patients (one required medical treatment, one required surgical treatment).

**Conclusion:** With attention to detail, LSG can lead to good long-term outcomes. Trends to success include repair of hiatal hernia at angular incisions and complete resection of posterior fat

efficiency has also been questioned and some of these have been underreported due to publication bias. Although addressed by a recent consensus multiple controversies regarding the technique in part but what has led to the variable patient outcomes was to ascertain efficacy of weight loss in our experience of 500 consecutive cases. **Conclusion:** LSG is a safe and effective procedure for weight loss in our experience of 500 consecutive cases.

### Methods

A retrospective review was performed from a database (Lapbase Data Manager for Bariatric Surgery) of the first 500 patients who under-



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ELSEVIER

Camilo Boza, M.D., Da Ricarc  
Department of Digestive

### Abstract

**Background:** Laparoscopic sleeve gastrectomy (LSG) is a minimally invasive bariatric procedure. The aim of this study was to evaluate the long-term outcomes of LSG. **Methods:** Retrospective review of 161 patients who underwent LSG between 2008 and 2014. **Results:** A total of 161 patients were included in the study. Mean age was 46.9 years (range 33–75 years). Mean BMI was 44.2 kg/m<sup>2</sup> (range 33–75 kg/m<sup>2</sup>). Mean follow-up time was 26.7 months (range 12–48 months). **Conclusion:** LSG is a safe and effective procedure for weight loss in our experience of 161 patients.

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## Five-year results of laparoscopic sleeve gastrectomy

Patricia Sieber<sup>1</sup>\*, Markus Gass, M.D.<sup>2</sup>, Beatrice Kern, M.D.<sup>3</sup>, Thomas Peters, M.D.<sup>3</sup>, Marc Slawik, M.D.<sup>3</sup>, Ralph Peterli, Ph.D.<sup>3</sup>

<sup>1</sup>Department of Surgery, St. Clarapital, Basel, Switzerland  
<sup>2</sup>Interdisciplinary Center of Nutritional and Metabolic Diseases, St. Clarapital, Basel, Switzerland  
Received March 22, 2013; accepted June 4, 2013

**Background:** Laparoscopic sleeve gastrectomy (LSG) is gaining popularity, but studies reporting long-term results are still rare. The objective of this study was to present the 5-year outcome concerning weight loss, modification of co-morbidities, and late complications. **Methods:** This is a retrospective analysis of a prospective cohort with a minimal follow-up of 5 years. A total of 68 patients underwent LSG either as primary bariatric procedure (n=41) or as redo operation after failed laparoscopic gastric banding (n=27) between August 2004 and December 2007. At the time of LSG, the mean body mass index (BMI) was 43.0 ± 3.0 kg/m<sup>2</sup>, the mean age 43.1 ± 10.1 years, and 79% were female. The follow-up rate was 100% at 1 year postoperatively, 97% after 2 years, and 91% after 5 years; the mean follow-up time was 5.2 ± 0.8 year. **Results:** The average excessive BMI loss was 61.5% ± 23.4% after 1 year, 61.1% ± 23.4% after 2 years, and 57.4% ± 24.7% after 5 years. Co-morbidities improved considerably; a remission of type 2 diabetes could be reached at 85%. The following complications were observed: 1 leak (1.5%), 2 incisional hernias (2.9%), and new-onset gastroesophageal reflux in 11 patients (16.2%). Reopera-

tion was necessary in 11 patients (16.2%). The LSG is merely a sleeve resection, but it is associated with an accelerated gastric emptying rate, leading to a higher risk of gastroesophageal reflux disease (GERD) and weight regain.

**Conclusion:** LSG is a safe and effective procedure for weight loss in our experience of 68 patients. The LSG is merely a sleeve resection, but it is associated with an accelerated gastric emptying rate, leading to a higher risk of gastroesophageal reflux disease (GERD) and weight regain.

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## Long-term outcomes of laparoscopic sleeve gastrectomy as a primary bariatric procedure

Camilo Boza, M.D., Da Ricarc  
Department of Digestive

### PAPER OF THE 21ST ANNUAL ESA MEETING

## Gastroesophageal Reflux Disease and Laparoscopic Sleeve Gastrectomy: A Physiopathological Evaluation

Fabrizio Rebecchi, MD, Marco E. Altieri, MD, PhD, Claudio Giacomin, MD, Elettra Uglietta, MD, Gianna Scozzari, MD, and Mario Marino, MD

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# Long-term studies

Study / Author	Year	Nr. patients	Mean follow-up (years)	Conversion (%)	Weight loss (%EWL)	Reflux (%)	Barrett (%)	ΔBMI Kg/m2
Noel	2017	168	8.0	16.6	67.0	31.0	N/A	11.4
Kowalewsky	2018	100	8.0	16.0	51.1	56.0	N/A	12.1
Mandeville	2017	100	8.5	29.5	60.8	47.8	N/A	9.1
Sarela	2012	20	8.0-9.0	20.0	68.0	35.0	N/A	14.0
Gissey	2018	144	10.0	2.0	52.5	24.0	N/A	15.1
Chang	2018	65	10.0	16.9	70.5	50.0	N/A	10.9
Felsenreich	2018	103	11.0	33.0	50.0	57.0	14.0	13.5
Arman	2016	110	11.7	25.0	62.5	21.4	N/A	10.1

# Long-term studies

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# METABOLIC & BARIATIC Surgery

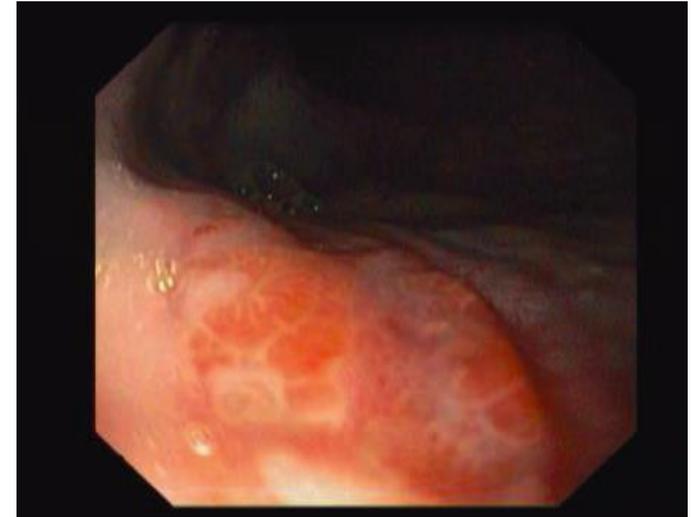
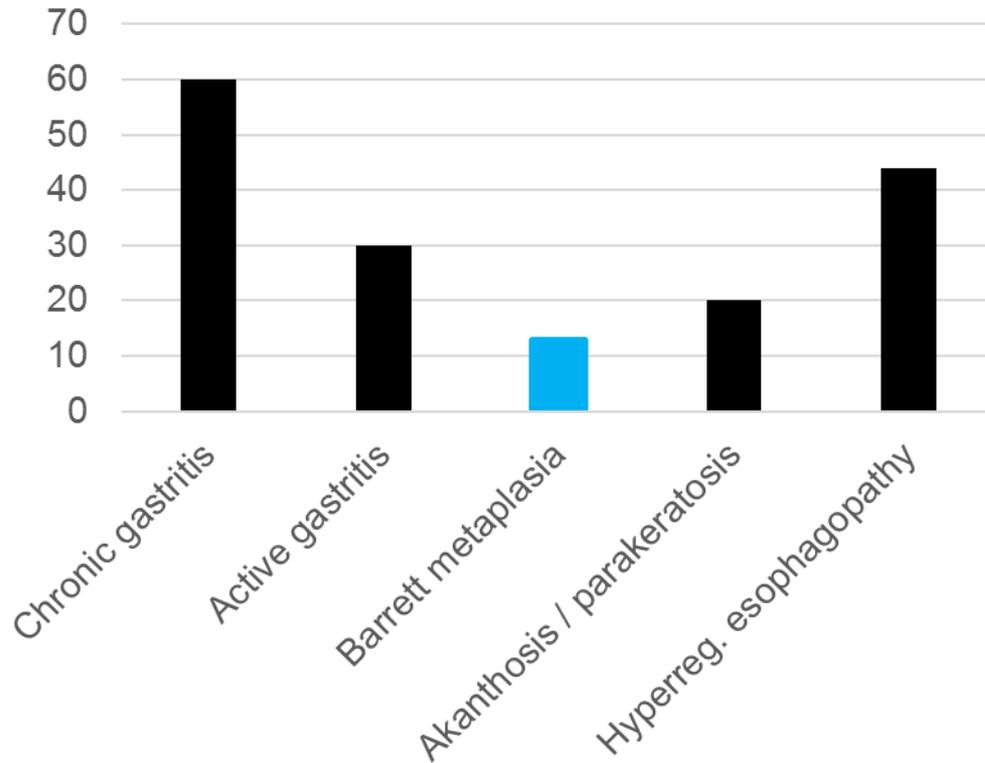
University Clinic for General Surgery – AKH Vienna



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Sleeve not converted n=50

## Gastroscopy histology (%)



**6 patients (14%) Barrett metaplasia (without dysplasia)**



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# Barrett's Esophagus



Surgery for Obesity and Related Diseases 13 (2017) 568–574

SURGERY FOR OBESITY  
AND RELATED DISEASES

Original article

## Gastroesophageal reflux disease and Barrett's esophagus after laparoscopic sleeve gastrectomy: a possible, underestimated long-term complication

Alfredo Genco, M.D.<sup>a</sup>, Emanuele Soricelli, M.D.<sup>a,\*</sup>, Giovanni Casella, M.D., Ph.D.<sup>a</sup>,  
Roberta Maselli, M.D.<sup>a</sup>, Lidia Castagneto-Gissey, M.D.<sup>a</sup>, Nicola Di Lorenzo, M.D.<sup>b</sup>,  
Nicola Basso, M.D.<sup>a</sup>

110 patients

5 years follow-up

**Follow-up rate: 69.1%**

**Barrett's esophagus: 17.1%**

**GERD: pre-OP 34%; post-OP 68%**

110 patients	Preoperative	Follow-up	<i>P</i>
GERD symptoms	33.6% (37 pts)	68.1% (75 pts)	<.0001
VAS score	1.8	3	.018
Daily PPI intake	19.1% (21 pts)	57.2% (63 pts)	<.0001
Class A esophagitis	12.7% (14 pts)	46.3% (51 pts)	<.0001
Class B esophagitis	8.1% (9 pts)	32.7% (36 pts)	<.0001
Class C esophagitis	3.6% (4 pts)	11.8% (13 pts)	.04
Class D esophagitis	0	9.1% (10 pts)	.0016
Barrett's esophagus	0	17.2% (19 pts)	<.0001

# Reflux after SG

Clinical Review & Education

JAMA Network Insights

## Gastroesophageal Reflux After Sleeve Gastrectomy

Marco G. Patti, MD; Francisco Schlottmann, MD

The presence of preoperative GERD should be considered a relative contraindication to SG, and patients should be properly counseled.

Follow-up after SG should focus not only on weight loss and comorbidities but also on detection and treatment of GERD.

Patti M et al., Jama Surg 2018

# Esophagitis after SG

Obesity Surgery  
<https://doi.org/10.1007/s11695-018-3509-0>



ORIGINAL CONTRIBUTIONS



## Correlation Between Symptomatic Gastro-Esophageal Reflux Disease (GERD) and Erosive Esophagitis (EE) Post-vertical Sleeve Gastrectomy (VSG)

Chin Hong Lim<sup>1</sup> · Phong Ching Lee<sup>2</sup> · Eugene Lim<sup>1</sup> · Jeremy Tan<sup>1</sup> · Weng Hoong Chan<sup>1</sup> · Hong Chang Tan<sup>2</sup> · Sonali Ganguly<sup>2</sup> · Kwang Wei Tham<sup>2</sup> · Alvin Eng<sup>1</sup>

97 patients LSG

Gastroscopy 13 month after SG

**Follow-up rate: 64.9%**

Symptoms	EGD findings		
	Erosive esophagitis	Without esophagitis	Total
Gastro-esophageal reflux disease	11 (40.7%)	16 (59.3%)	27
Asymptomatic	9 (32.1%)	19 (67.9%)	28
Total	20	35	55

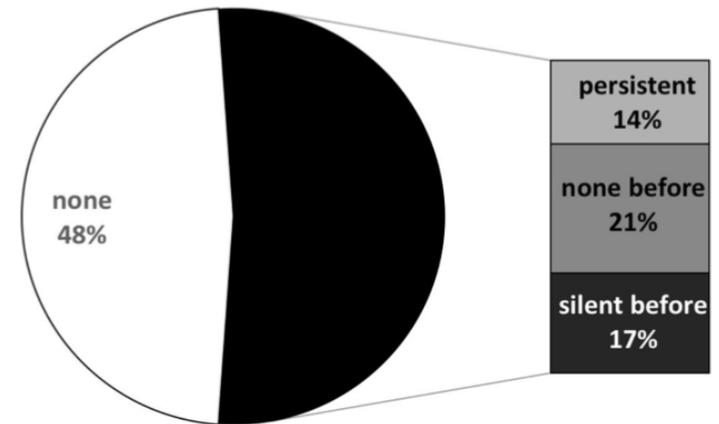
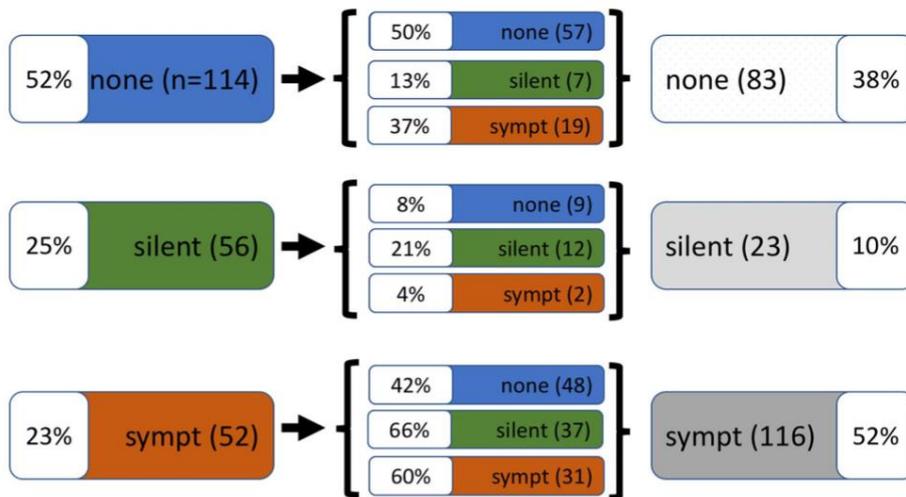
Interestingly, there was no correlation between GERD symptomology with endoscopic evidence of erosive esophagitis.

Hong Lim C et al., Obes Surg 2018

## De novo gastroesophageal reflux disease after sleeve gastrectomy: role of preoperative silent reflux

Yves Borbély<sup>1</sup>  · Esther Schaffner<sup>1</sup> · Lara Zimmermann<sup>1</sup> · Michael Huguenin<sup>1</sup> · Gabriel Plitzko<sup>1</sup> · Philipp Nett<sup>1</sup> · Dino Kröll<sup>1</sup>

Received: 19 April 2018 / Accepted: 6 July 2018  
 © Springer Science+Business Media, LLC, part of Springer Nature 2018



**Conclusion** LSG leads to a considerable rate of post-operative GERD. De novo-GERD consist of around half of pre-operative silent GERD and completely de novo-GERD. Most patients with pre-operative silent GERD became symptomatic.

Borbely Y et al., Surg Endosc 2018

# Barrett's Esophagus



Surgery for Obesity and Related Diseases 13 (2017) 568–574

SURGERY FOR OBESITY  
AND RELATED DISEASES

Original article

## Gastroesophageal reflux disease and Barrett's esophagus after laparoscopic sleeve gastrectomy: a possible, underestimated long-term complication

Alfredo Genco, M.D.<sup>a</sup>, Emanuele Soricelli, M.D.<sup>a,\*</sup>, Giovanni Casella, M.D., Ph.D.<sup>a</sup>,  
Roberta Maselli, M.D.<sup>a</sup>, Lidia Castagneto-Gissey, M.D.<sup>a</sup>, Nicola Di Lorenzo, M.D.<sup>b</sup>,  
Nicola Basso, M.D.<sup>a</sup>

No significant correlations were found between GERD symptoms and endoscopic findings.



As a consequence, **routine careful endoscopic evaluation** in the **postoperative surveillance** of SG patients should be encouraged, regardless of presence or absence of GERD symptoms.

# Barrett's Esophagus

Surg Endosc (2018) 32:930–936  
<https://doi.org/10.1007/s00464-017-5768-6>



## Barrett's esophagus before and after Roux-en-Y gastric bypass for severe obesity

Brandon Andrew<sup>1</sup> · Joshua B. Alley<sup>2</sup> · Cristina E. Aguilar<sup>3</sup> · Robert D. Fanelli<sup>4</sup>

19 patients

12 months follow-up

**42.9% Barrett's regression after RYGB +/- Hiatal hernia repair**

# Barrett's Esophagus

## Barrett's esophagus after Roux-en-Y gastric bypass: does regression occur?

Verónica Gorodner<sup>1</sup>

 Rudolf Buxhoeveden<sup>1</sup> · Gastón Clemente<sup>1</sup> · Christian Sa´nchez<sup>2</sup> · Luis Caro<sup>2</sup> · Alejandro Grigaites<sup>1</sup>

11 patients

Mean follow-up: 41±31 months

**36% Barrett's regression after RYGB**, no progression to dysplasia

# Barrett's Esophagus

## The Evaluation and Management of Suspicious Gastric Lesions Following Bariatric Surgery



**RYGB best treatment option for morbid obesity complicated with Barrett's esophagus**

Braghetto I, *Obes Surg* 2016;26:1622–6

**RYGB has shown the ability to induce regression of BE in the obese** in terms of decreased length of BE, improvement in the degree of dysplasia, and reconstitution of cardiac mucosa.

Houghton SG, *Surg Obes Relat Dis* 2008;4:1–4.

Csendes A, *J Gastrointest Surg* 2006;10:259–64

Cobey F, *Obes Surg* 2005;15:710–2.

Csendes A, *Surgery* 2006;139:46–53.

*Surg Clin N Am* 97 (2017) 467–474

# Barrett's Esophagus

## The Evaluation and Management of Suspicious Gastric Lesions Following Bariatric Surgery



Roux-en-Y gastric bypass (**RYGB**) has shown a **superior therapeutic effect for GERD resolution** when compared with restrictive operations, including gastric band and sleeve gastrectomy

Pallati PK, SOARD 2014

Li J, Obes Surg 2016

Surg Clin N Am 97 (2017) 467–474

# Reflux – Our Data

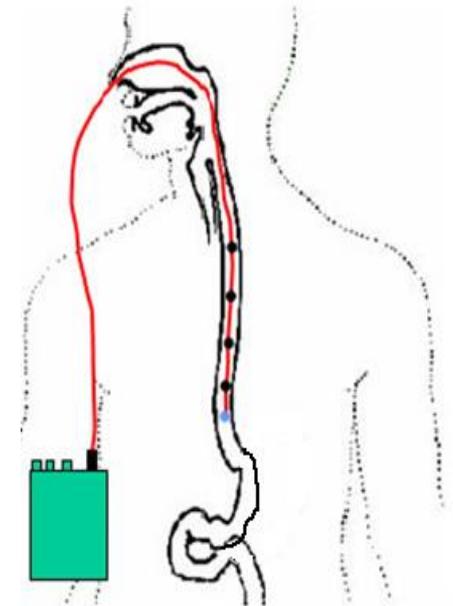
24h pH-metry:

Increased acid exposure time: 55.6% patients  
8.8%  $\pm$  8.3 (normal <4.2%)

Increased reflux activity in 24h: 44.5% patients  
72  $\pm$  52 (normal <73)

Increased De-Meester Score: 59.3% patients  
**40.2  $\pm$  36.6** (normal <14.72)

Sleeve not converted n=34

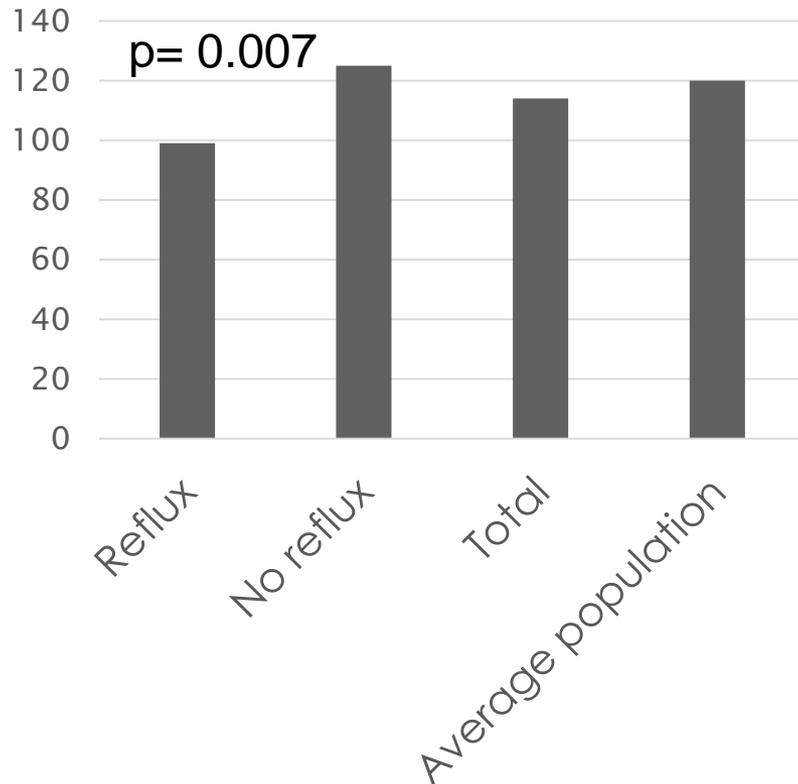


# Quality of Life – Our Data

Sleeve not converted n=54

## GiQLI

(Gastrointestinal Quality of Life Index)



Non-converted patients:

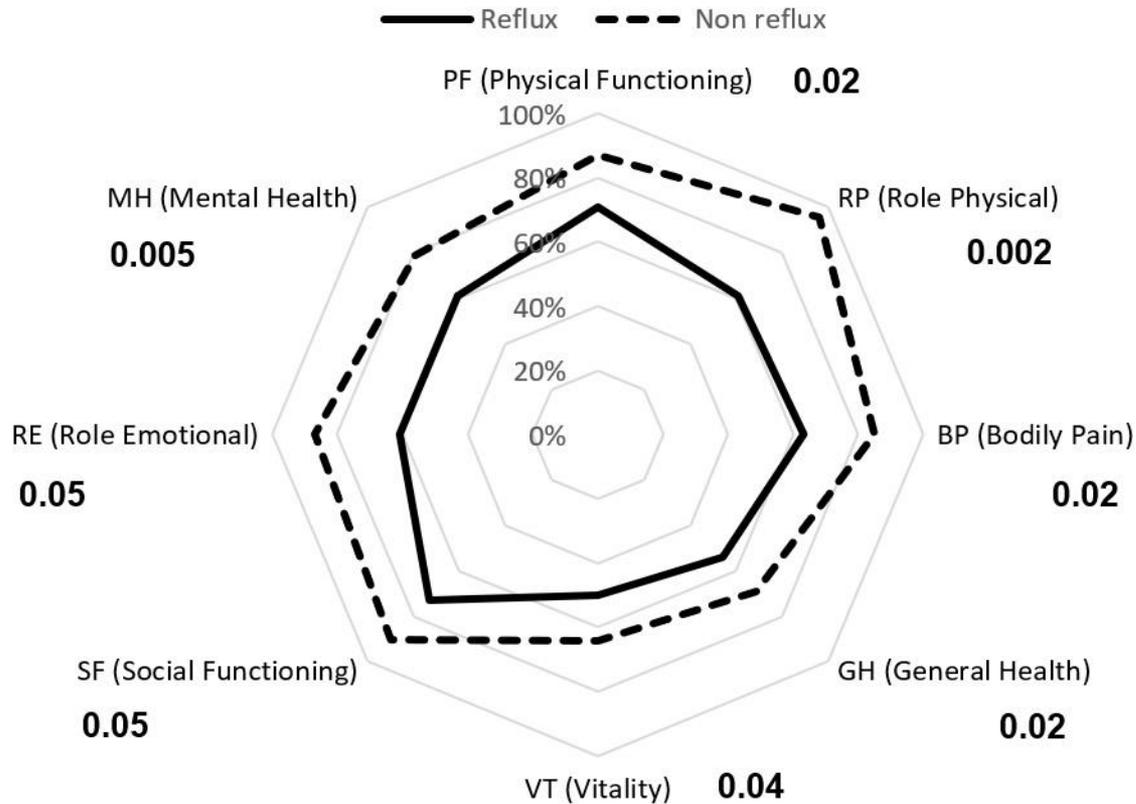
**Reflux: 54.6%**

**Non-Reflux: 45.4%**

# Quality of Life – Our Data

Sleeve not converted n=54

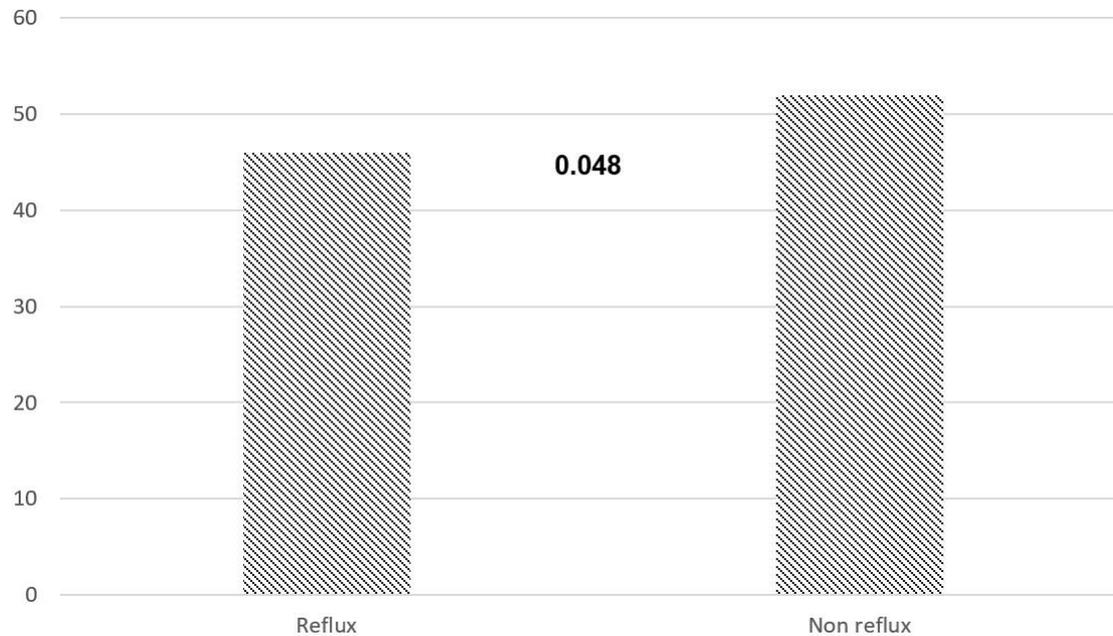
## SF-36 - Reflux



# Quality of Life – Our Data

Sleeve not converted n=54

## BQL - Reflux



# Long-term follow-up

## Moderating the Enthusiasm of Sleeve Gastrectomy: Up to Fifty Percent of Reflux Symptoms After Ten Years in a Consecutive Series of One Hundred Laparoscopic Sleeve Gastrectomies

Yannick Mandeville<sup>1</sup>  · Ruth Van Looveren<sup>1</sup> · Peter-Jan Vancoillie<sup>1</sup> · Xander Verbeke<sup>1</sup> · Katrien Vandendriessche<sup>1</sup> · Patrick Vuylsteke<sup>1</sup> · Paul Pattyn<sup>1</sup> · Bart Smet<sup>1</sup>

Follow-up: 8.5 years

**Follow-up rate: 88%**

Revisional rate: 29.5%

%EWL: 60.8%

**Table 4** Evolution of reflux disease and PPI use

	Preoperative	Postoperative	<i>p</i> value
Reflux disease	17 (17%)	44 (52%)	<0.0001
PPI use	15 (15%)	40 (47%)	<0.0001

**Table 5** Indications for secondary RYGB

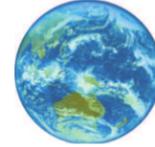
Indication	Number of patients (%)
Total	26 (100%)
Insufficient weight loss	19 (73.1%)
Insufficient weight loss + reflux disease	5 (19.2%)
Reflux disease without insufficient weight loss	2 (7.7%)

The chance of developing de novo reflux after LSG was 47.8% (32/67).

Mandeville Y et al., Obes Surg 2017

# Adenocarcinoma

## IMAGES FOR SURGEONS

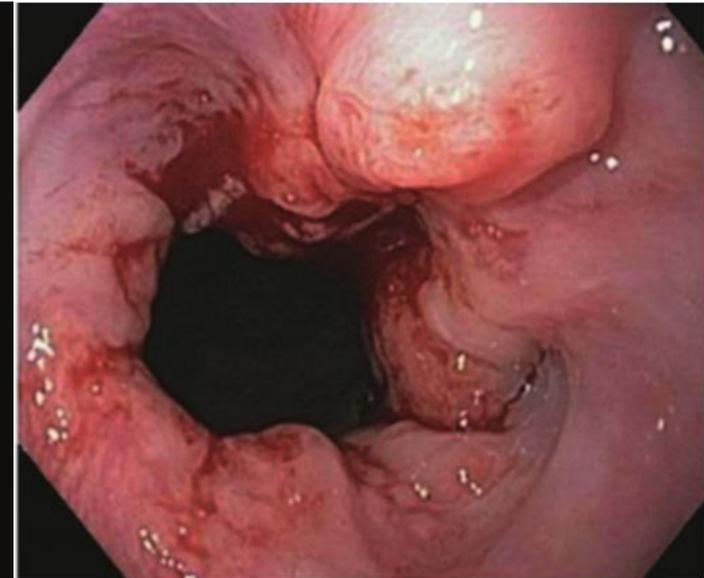


ANZJSurg.com

### Adenocarcinoma of the gastro-oesophageal junction after sleeve gastrectomy: a case report

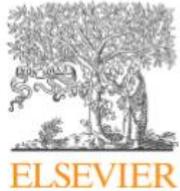
2.5 years after SG

No postoperative reflux



Sohn Set al., Anz J Surg 2017

# Adenocarcinoma



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)



## Esophageal adenocarcinoma in Barrett's esophagus after sleeve gastrectomy: Case report and literature review

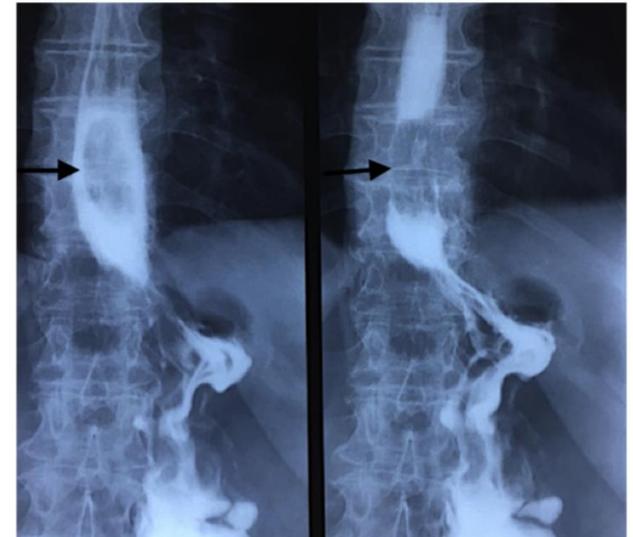


Lionel El Khoury, Rosa Benvenega, Rodolfo Romero, Regis Cohen\*, Joel Roussel, Jean-Marc Catheline

### 3 years after SG

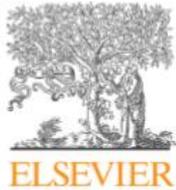
Perioperative Barrett's esophagus without dysplasia

**CONCLUSION:** Preoperative endoscopy should be performed in order to detect GERD, BE, and potential carcinomas of the upper gastrointestinal tract before undergoing bariatric surgery. The long-term monitoring after SG is essential.



El Khoury E et al., Int J Surg Case Rep 2018

# Adenocarcinoma



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## Esophageal adenocarcinoma five years after laparoscopic sleeve gastrectomy. A case report



Fernando Gabriel Wright, Agustin Duro\*, Juan Rodolfo Medici, Santiago Lenzi, Axel Federico Beskow, Demetrio Cavadas

### 5 years after SG

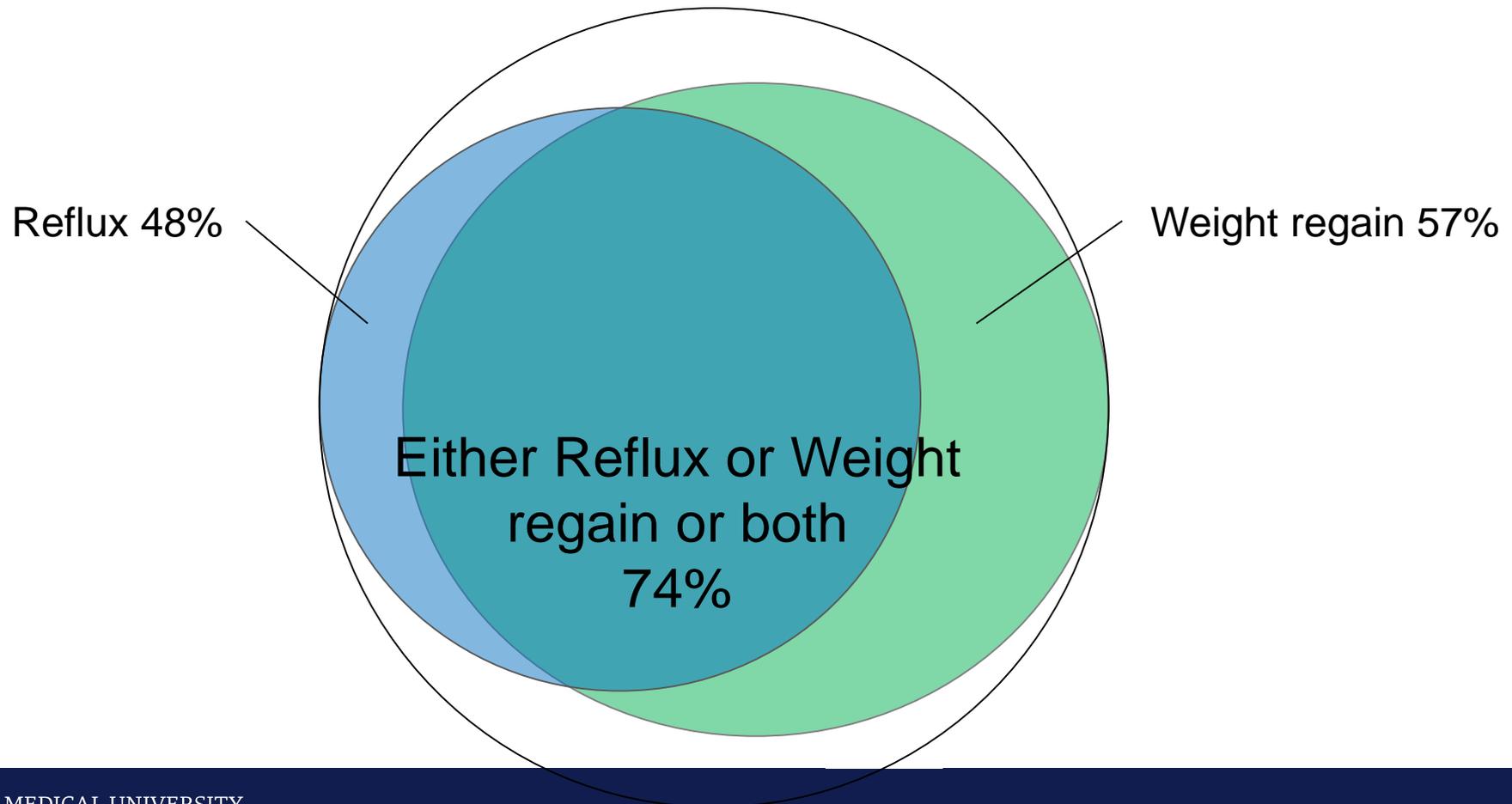
No reflux preoperative

Reflux started 15 months after SG



Wright F G et al., Int J Surg Case Rep 2017

Conclusion:



## Conclusion:

### Weight loss:



57% of all patients showed a mean value of 20kg weight regain after 10 years

### Reflux:



48% of all patients have symptomatic reflux after 10 years

### Outcome:

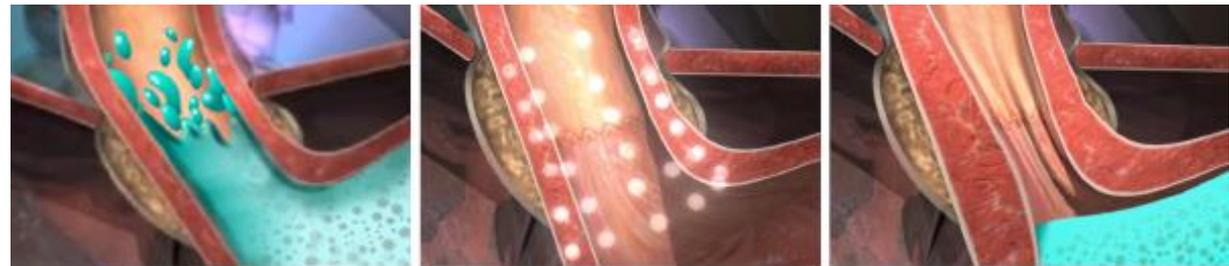


SG only moderate successful on the BAROS-score after 10 years

# Experimental / New Treatment of Reflux after SG

## Initial Experience of Endoscopic Radiofrequency Waves Delivery to the Lower Esophageal Sphincter (Stretta Procedure) on Symptomatic Gastroesophageal Reflux Disease Post-Sleeve Gastrectomy

Nesreen Khidir<sup>1</sup>  • Luigi Angrisani<sup>2</sup> • Jowhara Al-Qahtani<sup>3</sup> • Sheraz Abayazeed<sup>3</sup> • Moataz Bashah<sup>1,4</sup>



Reflux - weak muscle allows stomach contents to reflux into esophagus

Stretta Therapy - treats muscle with radiofrequency energy

Post-Stretta - thicker muscle prevents reflux

Patients: 15

Stretta: Endoscopic Radiofrequency of the LES

**Conclusions** Stretta did not improve GERD symptoms in patients post-LSG at short-term follow-up, and about 6.7% complication rate was reported. Patients were not satisfied despite the decrease in PPI dose.

Khidir N et al., Obesity Surgery 2018

# Experimental / New Treatment of Reflux after SG

Original article

Electrical stimulation of the lower esophageal sphincter to address gastroesophageal reflux disease after sleeve gastrectomy

Yves Borbély, M.D., F.A.C.S.<sup>a,\*</sup>, Nicole Bouvy, M.D.<sup>b</sup>, Henning G. Schulz, M.D.<sup>c,†</sup>, Leonardo Antonio Rodriguez, M.D.<sup>d</sup>, Camilo Ortiz, M.D.<sup>e</sup>, Alejandro Nieponice, M.D.<sup>f</sup>

<sup>a</sup>Clinic for Visceral Surgery and Medicine, Inselspital, Bern University Hospital, and University of Bern, Bern

<sup>b</sup>University of Maastricht, Maastricht, the Netherlands

<sup>c</sup>Evangelisches Krankenhaus, Castrup-Rauxel, Germany

<sup>d</sup>Surgery, CCO Obesidad, Santiago, Chile

<sup>e</sup>Department of Surgery, Hospital El Tunal, Bogota, Colombia

<sup>f</sup>Esophageal Surgery Program, University of Favaloro, Buenos Aires, Argentina

Received July 16, 2017; accepted February 3, 2018

Patients: 17

Follow-up: 6 months

## Conclusions

Electrical stimulation of LES in post-LSG patients suffering from symptomatic GERD refractory to medication led to a significant improvement of GERD-symptoms, esophageal acid exposure, and overall decrease of need for PPI. Preserving the post-LSG anatomy, it offers a valid option for patients unable or unwilling to undergo RYGB.

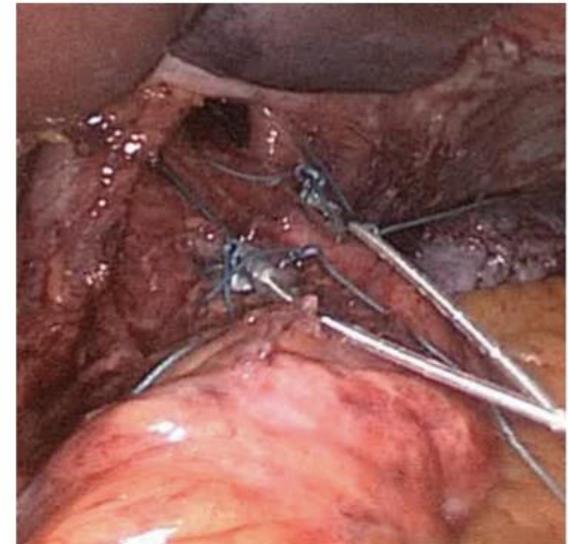


Fig. 1. Electrodes sewn into the esophageal wall beneath the lower esophageal sphincter.

Borbey Y et al., SOARD 2018

# Experimental / New Treatment of Reflux after SG

## Gastroesophageal Reflux Management with the LINX® System for Gastroesophageal Reflux Disease Following Laparoscopic Sleeve Gastrectomy

Kenneth Desart<sup>1</sup> • Georgios Rossidis<sup>1</sup> • Michael Michel<sup>1</sup> • Tamara Lux<sup>1</sup> • Kfir Ben-David<sup>2</sup>

Patients: 7

Follow-up: 2-4 weeks

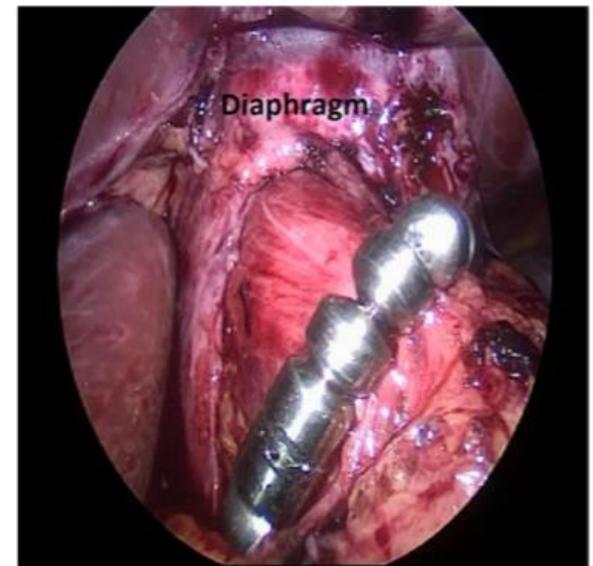


Fig. 2 Placement of LINX® device

*Conclusion* This is the first reported pilot case series, illustrating that the LINX® device is a **safe and effective option** in patients with de novo refractory gastroesophageal reflux disease after a laparoscopic sleeve gastrectomy despite appropriate weight loss.

Desart K et al., J Gastrointestinal Surg 2015

# Conclusion

*Which Treatment of Severe Reflux and Esophagitis After Sleeve Gastrectomy?*

**Symptoms Control:** PPI, Sucralan, ...

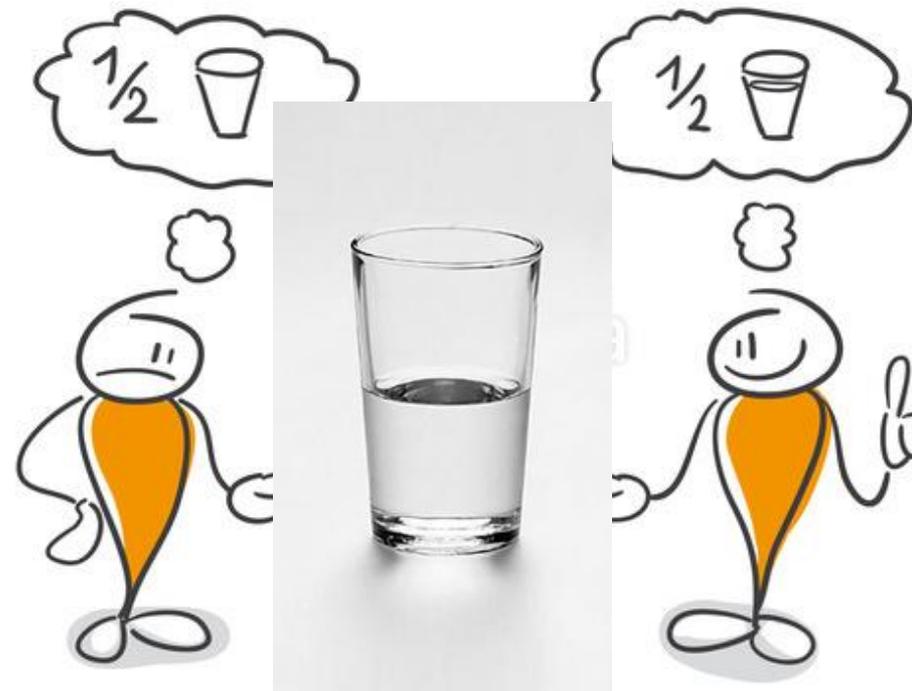
**Reflux / Barrett's Esophagus:**

- RYGB

**Reflux and Weight Regain:**

- RYGB with **short alimentary limb** (app. 60-70cm) and a **longer BPL** (100 – 150cm)

# Long term data



#86217410



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