



## Results of Metabolic Surgery

**DMT2**

**hypertension**

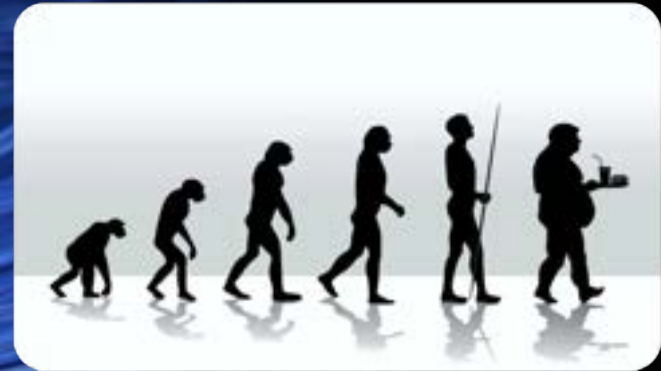
**dyslipidemia**

**sleep apneae**

**Miroslav D. Ilic**



## „GLOBESITY”



- ✓ world-wide epidemic
- ✓ prevalence (USA) 36% adult, 17% adolescent
- ✓ 15% adult population in USA = severe obesity (BMI > 35 kg/m<sup>2</sup>)
- ✓ fifth leading risk of death world-wide (WHO)
- ✓ responsible for 80% cases with DMT2, 35% ischaemic heart disease, 55% hypertensive disease

*Fried M, Yumuk V, Oppert JM, Scopinaro N, Torres AJ, Weiner R, Yashkov Y, Fruhbk G. Interdisciplinary European Guidelines on Metabolic and Bariatric Surgery. Obes Facts 2013;6:449–468 .*



## **Resolution of Metabolic Disorders → Metabolic Surgery**

**1990 – 2003**

**22 094 patients**

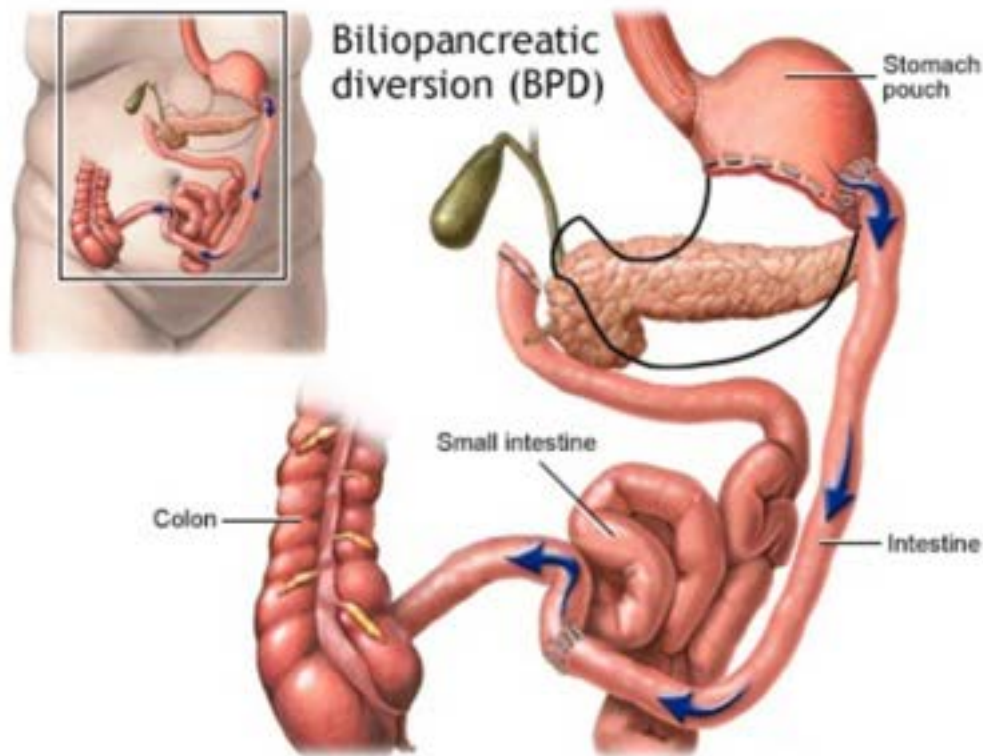
**Mean % EWL = 61,2**

	<b>Completely resolved</b>	<b>Improved</b>
<b>Diabetes (DMT2)</b>	<b>76,8%</b>	<b>86%</b>
<b>Hyperlipidemia</b>		<b>70%</b>
<b>Hypertension</b>	<b>61,7%</b>	<b>78,5%</b>
<b>Obstructive sleep apnea</b>	<b>85,7%</b>	<b>83,6%</b>

*Buchwald H, Avidor Y, Braunwald E et al. Bariatric Surgery: A Systematic Review and Meta-analysis. JAMA. 2004; 292 (14): 1724-1737.*



## Milestone of Metabolic Surgery



Scopinaro (1986)





# Evaluation of Metabolic Surgery

## Bariatric Surgery (1953)



## Metabolic Surgery (1978)

*“as the operative manipulation of a normal organ or organ system to achieve a biological result for a potential health gain”.*

## Modern Metabolic Surgery / Procedures (2004)

*“a set of gastrointestinal operations used with the intent to treat diabetes (“diabetes surgery”) and metabolic dysfunctions (which include obesity)”.*

*F. Rubino*



*Metabolic Surgery. Editors: Buchwald H, Varco RL, New York: Grune and Stratton; 1978.*

*Buchwald H, Buchwald JN. Evolution of operative procedures for the management of morbid obesity 1950–2000.*

*Obes Surg 2002;12:705–17.*



## Mechanism of Metabolic Surgery on DMT2

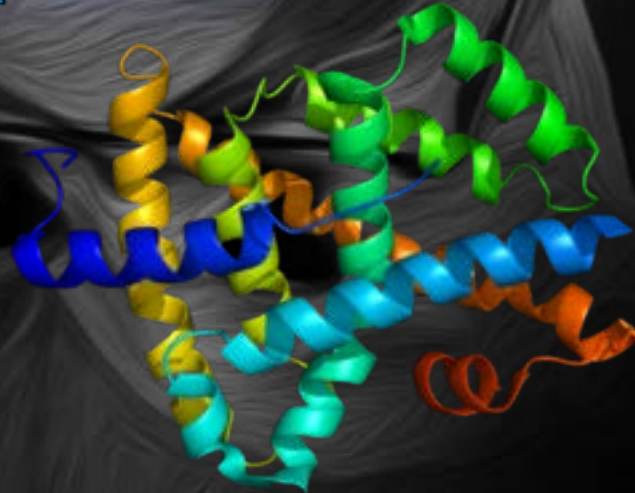
Poorly understood  
Field of intensive research

Experimentally proven

**Farnesoid X receptor – bile acid receptor or NR1H4.**

Nuclear receptor that is encoded by the *NR1H4* gene in humans.

Suppression of cholesterol 7 alpha-hydroxylase (CYP7A1), the rate-limiting enzyme in bile acid synthesis from cholesterol.



*Conserved Shifts in the Gut Microbiota Due to Gastric Bypass Reduce Host Weight and Adiposity* Alice P. Liou,<sup>1</sup> Melissa Paziuk,<sup>1</sup> Jesus-Mario Luevano [www.ScienceTranslationalMedicine.org](http://www.ScienceTranslationalMedicine.org) 27 March 2013 Vol 5 Issue 178 178ra41

*Karen K. Ryan, Valentina Tremaroli, Christoffer Clemmensen et al. FXR is a molecular target for the effects of vertical sleeve gastrectomy. Nature. 2014 May 8; 509(7499): 183–188. doi:10.1038/nature13135.*



## Trends in Bariatric surgery 2012-2015 (USA)

Premier database

<b>LSG</b>	38%	↗	63%
<b>RYGB</b>	44%	↘	30%
<b>LAGB</b>	13%	↘	2%
<b>RYGB/LSG</b>	<b>DMT2</b>		<b>36%/25%</b>

*Kizy S, Jahansouz C, Downey MC.*

*National Trends in Bariatric Surgery 2012-2015: Demographics, Procedure Selection, Readmissions, and Cost. Obes Surg. 2017 May 22. doi: 10.1007/s11695-017-2719-1*





# Common Metabolic Surgery

*R-Y-GBP*



*LAGB*



*LGS*





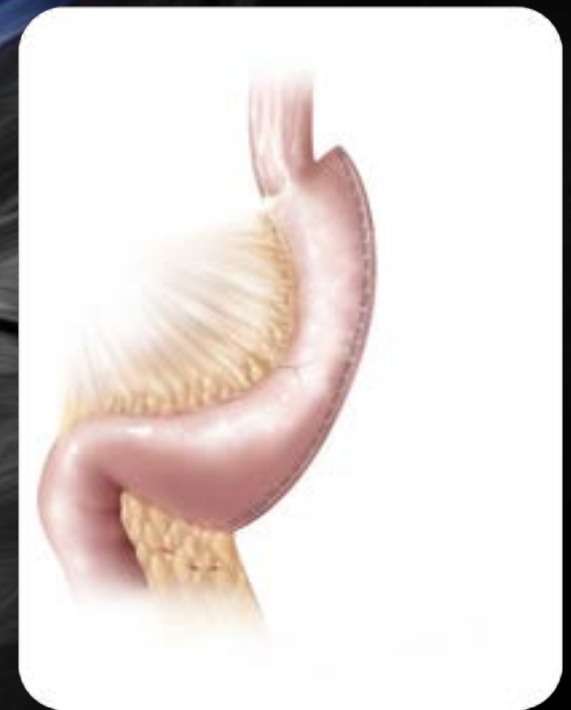


## **Definition**

*Sleeve gastrectomy is a surgical METABOLIC procedure in which the stomach is reduced to about 20-25% of its original size, by surgical removal along the greater curvature.*

*The result is a "sleeve" or tube like structure.*

*The procedure permanently reduces the size of the stomach, although there could be some dilatation of the stomach later on in life.*





## **Gastric Sleeve – New Method**

- 1988. Hess (USA) – restrictive component of BPD-DS
  - 1993. Jamieson (Australia) – "Long Vertical Gastroplasty"
  - 1995. Johnston (England) – "Magenstrasse and Mill procedure"
- 
- 1993. Marceau (Canada) – "new type" of "parietal gastrectomy" as a part of BPD-DS

*Gagner M, Trelles N. Updated Review of Sleeve Gastrectomy. The Open Gastroenterology Journal. 2008; 2, 41-49.*

*Marceau P, Biron S, Bourque RA, Potvin M, Hould FS, Simard S. Biliopancreatic Diversion with a New Type of Gastrectomy. Obes Surg. 1993 Feb; 3 (1): 29-35.*





## Laparoscopic Gastric Sleeve (LGS)

- 1999. Gagner (USA) – first laparoscopic gastric sleeve / restrictive part of BPD-DS
- 2000. Gagner (USA) – first step of two stage laparoscopic BPD-DS
- 2003. Gagner (USA) – first step of two stage LRYGBP

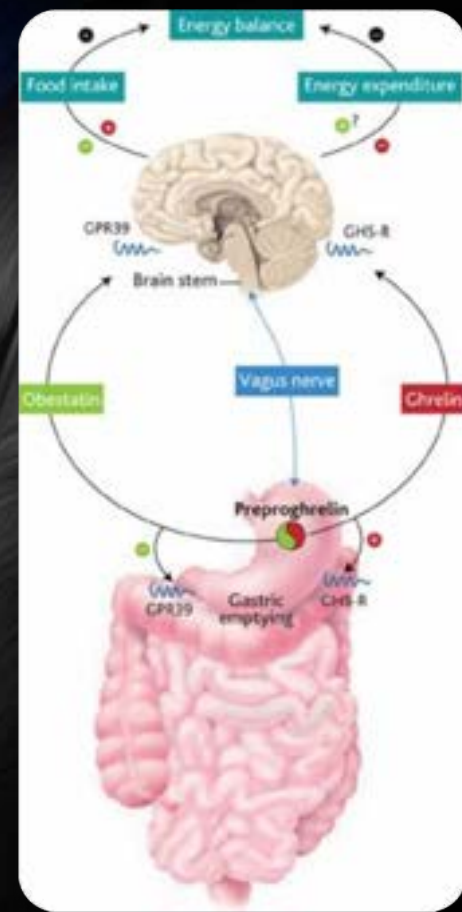
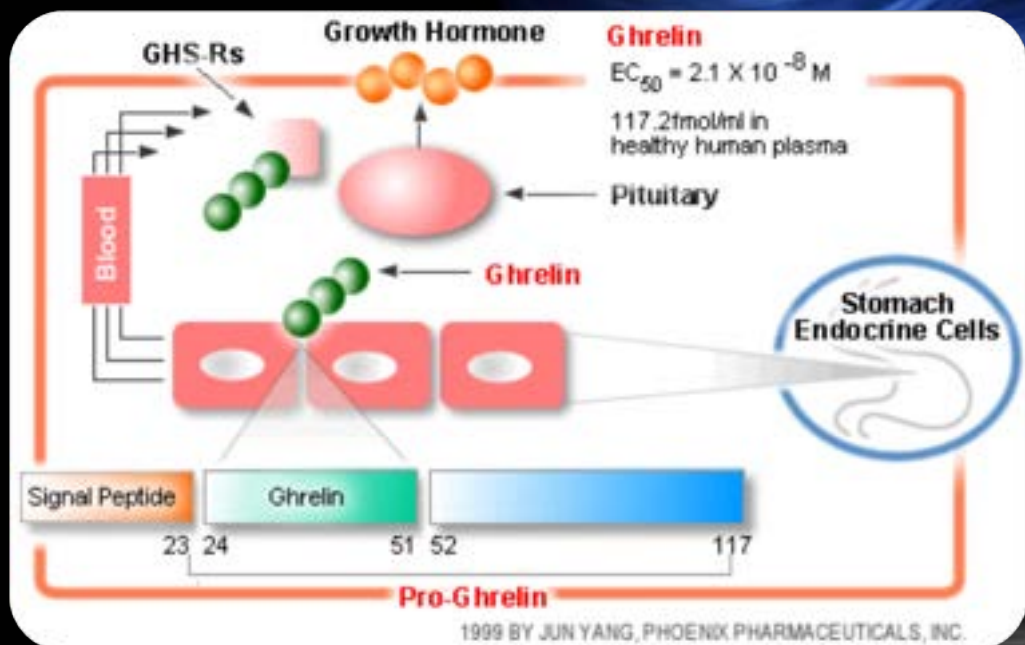
*Ren CJ, Patterson E, Gagner M. Early results of laparoscopic biliopancreatic diversion with duodenal switch: a case series of 40 consecutive patients. Obes Surg. 2000 Dec; 10 (6): 514-23; discussion 524.*







## LGS – Mechanism of action (hormonal benefits)



Reduced ghrelin (growth hormone releasing hormone)  
– „hormone of hunger”.

Significantly reduced in LGS vs gastric banding.

Langer FB, Reza Hoda MA, Bohdjalian A, Felberbauer FX, Zacherl J, Wenzl E, Schindler K, Luger A, Ludvik B, Prager G.  
Sleeve gastrectomy and gastric banding: effects on plasma ghrelin levels. *Obes Surg.* 2005 Aug; 15 (7): 1024-9.





## **Survey on LGS at the Fourth International Consensus Summit on Sleeve Gastrectomy**

1999. 46 133 LGS.

Conversion rate 0,2%.

LGS was intended as the sole operation in 93,1%.

6 year mean % EWL= 50,6.

If a second operation becomes necessary preference was:

RYGBP 46%, DS 24%, resleeve 20%, SAIDI 3%, sleeve plication 3%, mini-gastric bypass 3%, LAGB 2%.

Postoperative GERD 7,9%.

1999. Further long-term surveillance is necessary.

*Gagner M, Deitel M, Erickson AL, Crosby RD. Survey on laparoscopic sleeve gastrectomy (LSG) at the Fourth International Consensus Summit on Sleeve Gastrectomy. Obes Surg. 2013 Dec; 23 (12): 2013-7.*

## Technique

 **Journal of Investigative Surgery**  
Taylor & Francis  
ISSN: 0894-1939 (Print) 1521-0553 (Online) Journal homepage: <http://www.tandfonline.com/loi/ivrs20>

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### Surgical Technique: Laparoscopic Gastric Sleeve Resection in Super-Obese Patients

M. Ilic PhD & S.S. Putnik MD

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 Published online: 07 Apr 2017.





## **Our Experience with LGS (4)**

### **Technique**

#### **Removal of resected stomach**

- 1999. Without endobag through 15 mm hole (port)
- 2000. Control of resected stomach





## Long-term outcomes (11+ years)

**Isolated LSG provides a long-term %EBMIL od 62,5%.  
Conversion to another construction, required in 25% of the cases.  
Patient satisfaction score remains good despite unfavorable GERD outcomes.**

Arman GA, Himpens J, Dhaenens J. Long-term (11+years) outcomes in weight, patient satisfaction, comorbidities, and gastroesophageal reflux treatment after laparoscopic sleeve gastrectomy. *Surg Obes Relat Dis.* 2016 Dec;12(10):1778-1786. doi: 10.1016/j.soard.2016.01.013. Epub 2016 Jan 19.







## Metabolic Syndrome (MS)

A disorder of energy utilization and storage (3 of 5)

- ✓ central obesity (CO)
- ✓ elevated blood pressure (BP)
- ✓ elevated fasting plasma glucose (FPG)
- ✓ high serum triglycerides (TG)
- ✓ low high-density cholesterol (HDL) levels

### Other signs

impaired fasting glucose, insulin resistance ("prediabetes")

### Associated conditions

hyperuricemia  
fatty liver progressing to NAFLD  
polycystic ovarian syndrome (in women)  
erectile dysfunction (in men)  
acanthosis nigricans

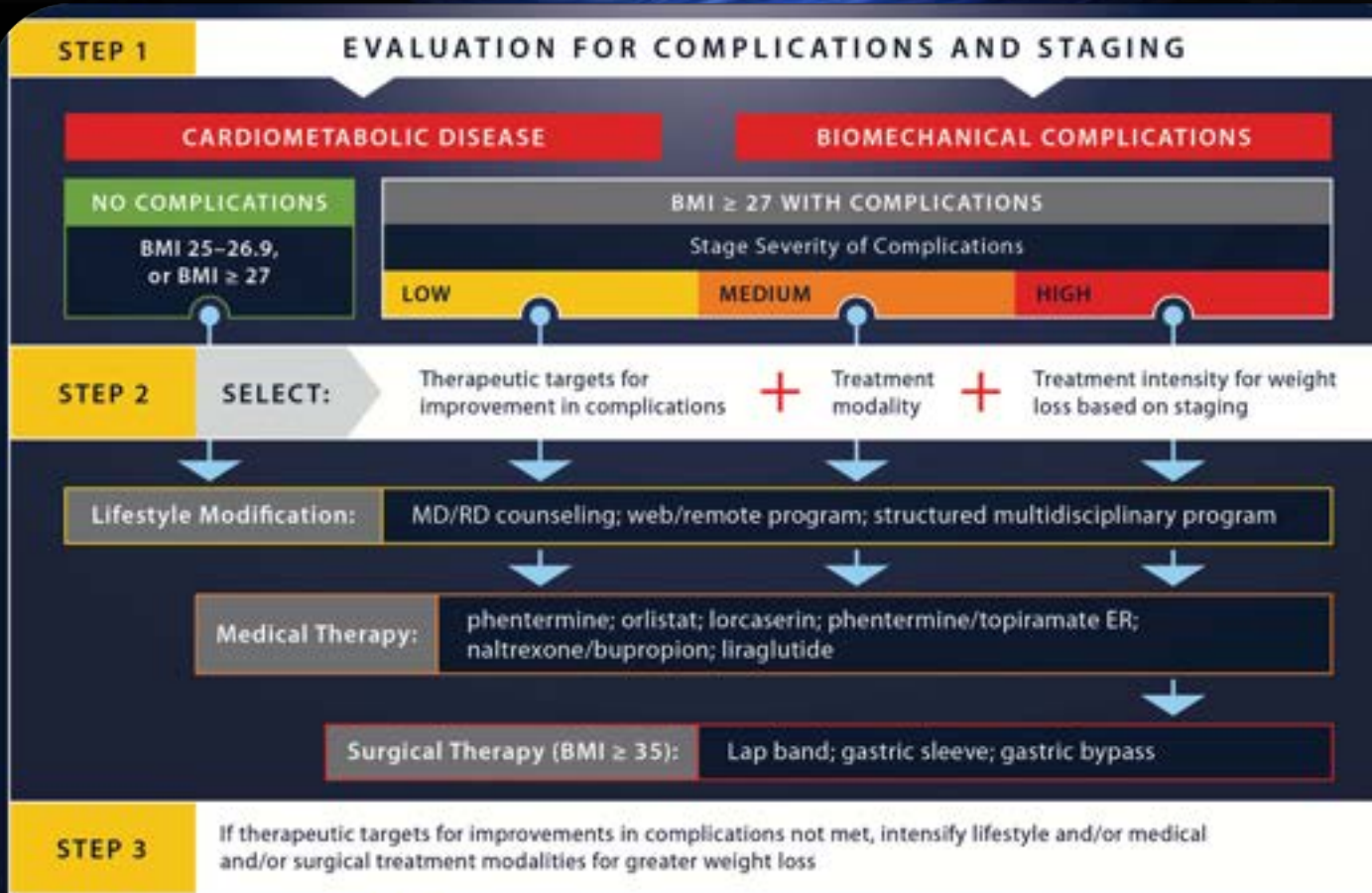




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## Metabolic Surgery for DMT2

*Surgically induced improvement of DMT2 may be considered effective if:*

- ✓ Postoperative insulin dose  $\leq 25\%$  of the preoperative one.
- ✓ Postoperative oral antidiabetic treatment dose  $\leq 50\%$  of the preoperative one.
- ✓ Postoperative reduction in HbA1c  $> 0.5\%$  within 3 months or reaching  $< 7.0\%$
- ✓ Patients with BMI  $\geq 30$  and  $< 35$  kg/m<sup>2</sup> with T2DM may be considered for bariatric surgery on an individual basis, as there is evidence-based data supporting bariatric surgery benefits in regards to T2DM remission or improvement.

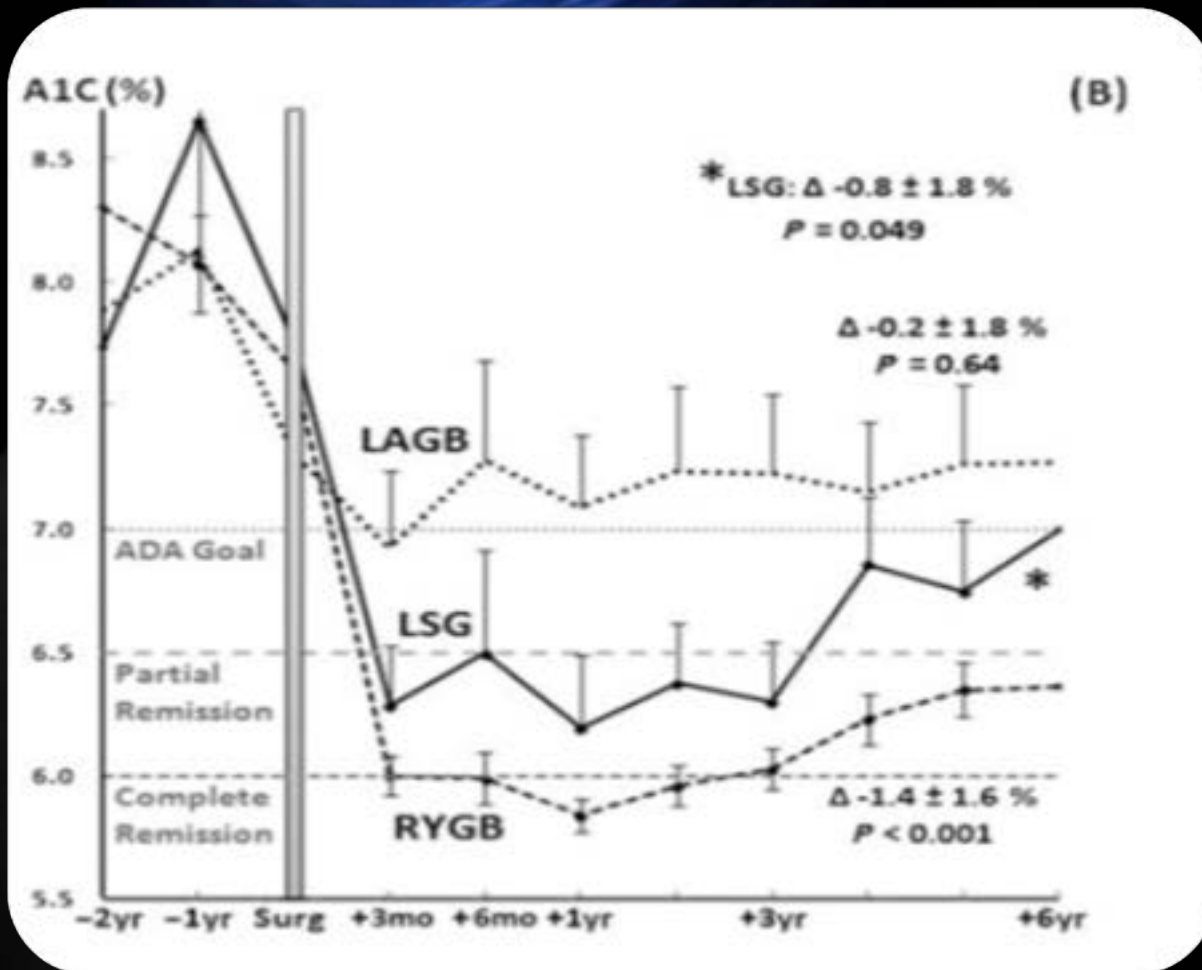
*Fried M, Yumuk V, Oppert JM, Scopinaro N, Torres AJ, Weiner R, Yashkov Y, Fruhbk G. Interdisciplinary European Guidelines on Metabolic and Bariatric Surgery. Obes Facts 2013;6:449–468.*





## Which surgical procedure for DMT2?

SAD, 217 pts.



Brethauer SA, Aminian A, Romero-Talamas H, et al. Can Diabetes Be Surgically Cured?: Long-Term Metabolic Effects of Bariatric Surgery in Obese Patients with Type 2 Diabetes Mellitus. *Ann Surg.* 2013 October ; 258(4): 628–637.





## Which surgical procedure for DMT2?

Procedure	DMT2 resolved
LAGB	48%
R-Y-GBP	84%
DS / BPD	98%

*Buchwald et al. JAMA 2004 Meta-analysis 136 studies, 22094 patients 1990-2003*



## Which surgical procedure for DMT2?

Procedure	DMT2 resolved
LAGB	<b>vomitting</b>
R-Y-GBP	84%
DS / BPD	<b>diarrhea</b>

*Buchwald et al. JAMA 2004 Meta-analysis 136 studies, 22094 patients 1990-2003*



## Which surgical procedure for DMT2?

Procedure	DMT2 resolved
LAGB	<b>vomitting</b>
R-Y-GBP	<b>golden standard</b>
DS / BPD	<b>diarrhea</b>

*Buchwald et al. JAMA 2004 Meta-analysis 136 studies, 22094 patients 1990-2003*



## Which surgical procedure for DMT2?

Procedure	DMT2 resolved
LAGB	48%
R-Y-GBP	84%
DS / BPD	98%

 Sleeve?

*Buchwald et al. JAMA 2004 Meta-analysis 136 studies, 22094 patients 1990-2003*







## **Complications**

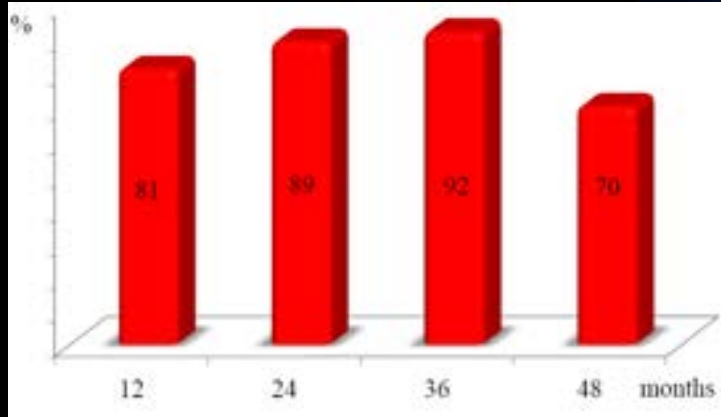
**4 pts. (1,3%) – postoperative bleeding (all solved in open procedure)**

**NO MORTALITY**

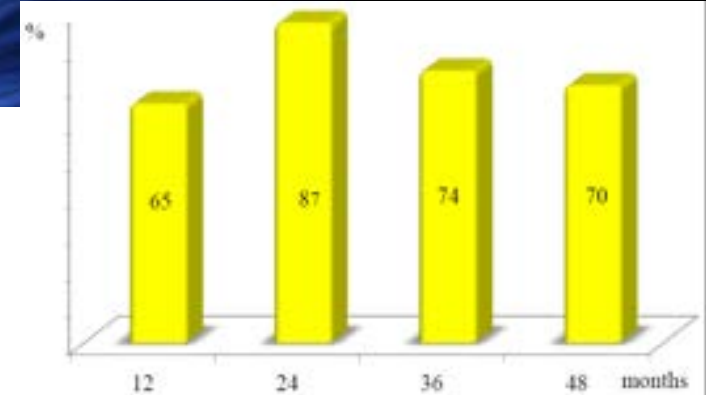


# Results of surgical treatment of MS (140 pts)

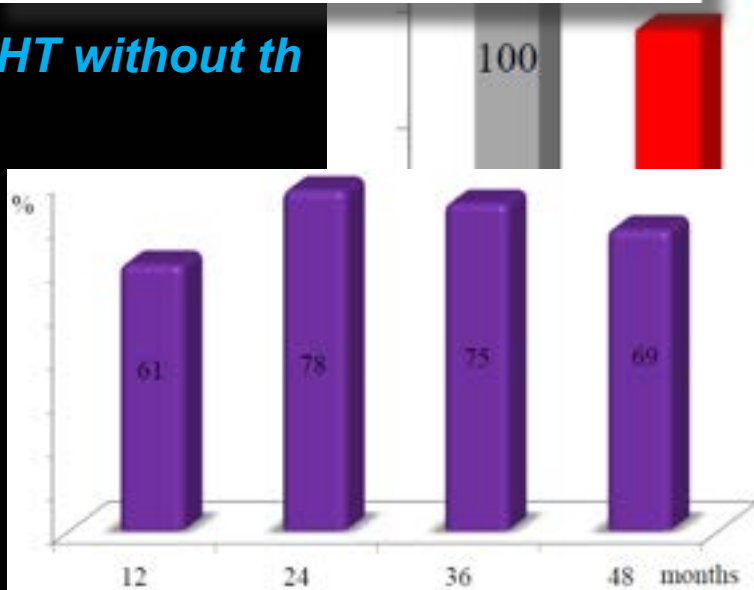
## Resolution



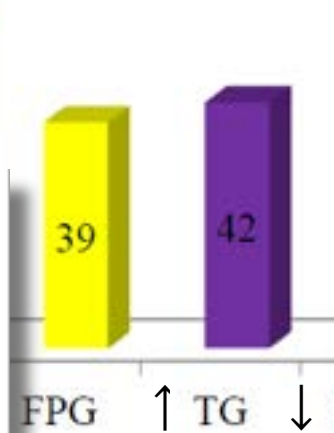
*HT without th*



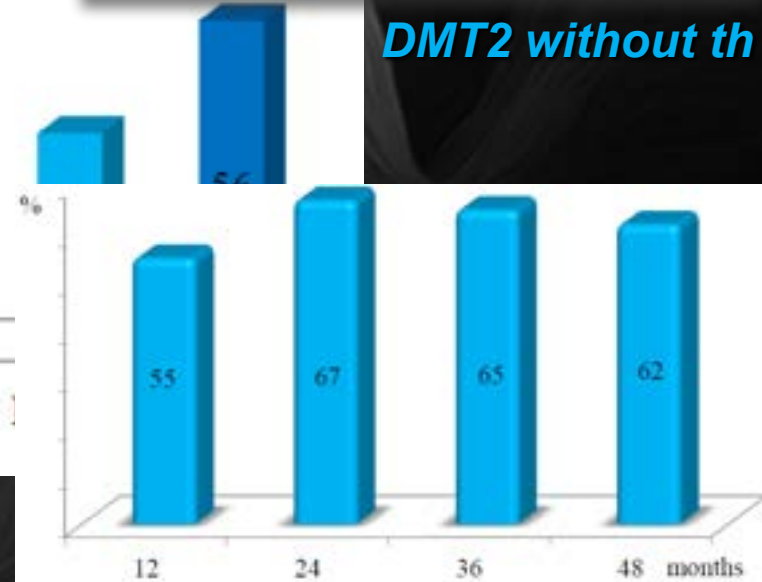
*DMT2 without th*



*< 1,7 mmol/l*



FPG ↑ TG ↓



*> 1,03 mmol/l M  
> 1,29 mmol/l F*





# Incidence of DMT2 after Metabolic Surgery

UK, 2167 pts. BMI>30 kg/m<sup>2</sup>

*Bariatric surgery is associated with reduced incidence of clinical diabetes in obese participants without diabetes at baseline for up to 7 years after the procedure.*

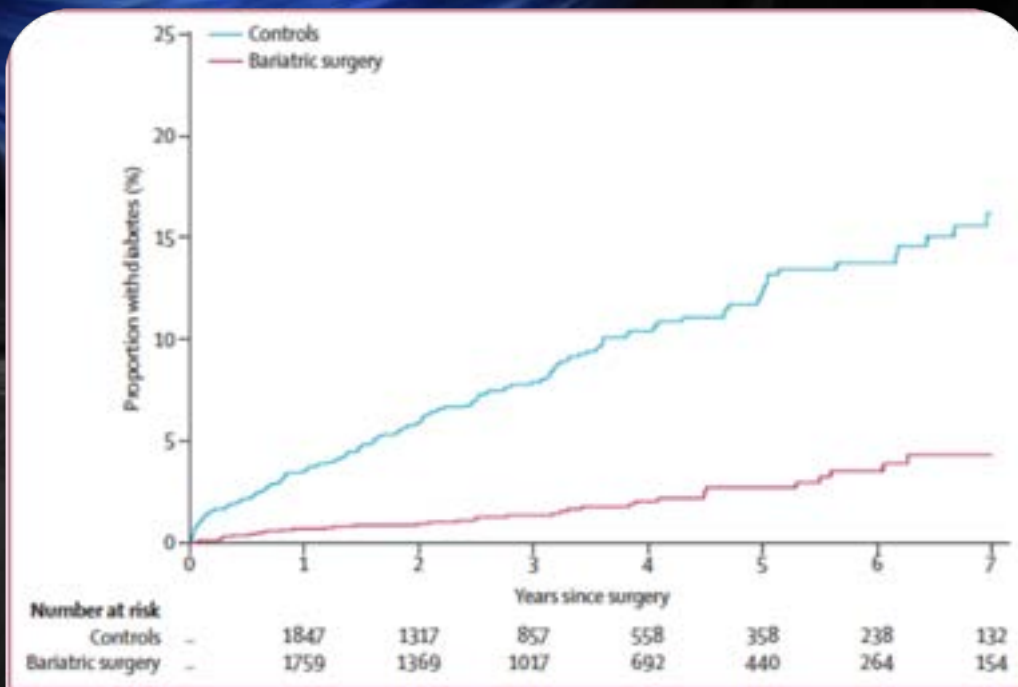


Figure: Incidence of type 2 diabetes in patients undergoing bariatric surgery and in matched controls during 7 years of follow-up

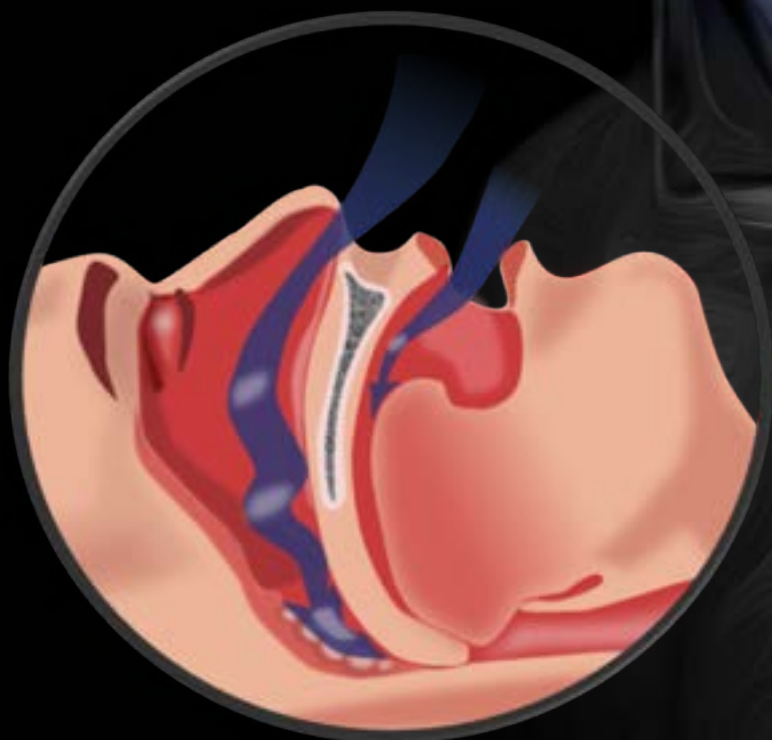
Booth H, Khan O, Prevost T. et al. Incidence of type 2 diabetes after bariatric surgery: population-based matched cohort study. *Lancet Diabetes Endocrinol* 2014; 2: 963–68



## Bariatric / Metabolic Surgery and OSA

13900 pts

*Resolution / Improvement*



**R-Y-GBP** 79%

**LAGB** 77%

**LGS** 86%

**DS / BPD** 99%

*Sarkhosh K, Switzer NJ, El-Hadi M, Birch DW, Shi X, Karmali S.  
The impact of bariatric surgery on obstructive sleep apnea: a  
systematic review. Obesity Surgery 2013; 23(3): 414-423.*



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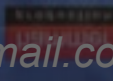
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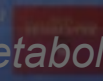
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## Conclusion

**Metabolic surgery is growing and distinctive surgical discipline.**

**Among different surgical procedures R-Y-GBP has greatest impact on long standing resolution on DMT2.**

**All bariatric / metabolic surgery procedures have acceptable results in treating metabolic syndrome much better than conservative treatment, and all of them are part of clinical guidelines .**

**CME is part of building on surgical knowledge and successful clinical practice.**