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NEW HORIZONS FOR METABOLIC SURGERY

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Metabolic/Bariatric Surgery Top Topics

IFSO, August 25, 2022

No Conflicts of Interest

Who controls the past controls the future.

Who controls the present controls the past.

George Orwell, 1984

HISTORICAL THOUGHT PRECEDENTS

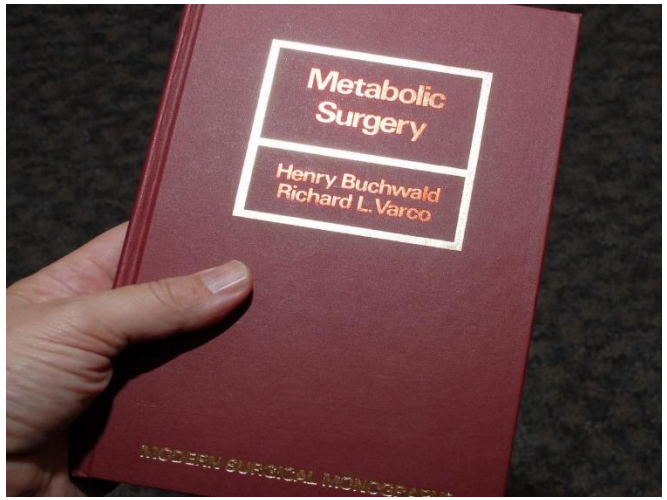
Ancient Greeks: Disease resulted from an imbalance of the four basic humors: yellow bile, black bile, phlegm, and blood

Rokitansky, 19th Century: Organ specific pathology: a heart attack was the fault of the heart, an ulcer that of the stomach or duodenum.

Metabolic Holistic Approach, 20th Century: Most disease processes involve a complex metabolic mosaic of causation.

DEFINITION: METABOLIC SURGERY

The operative manipulation of a normal organ or organ system to achieve a biological result for a potential health gain.



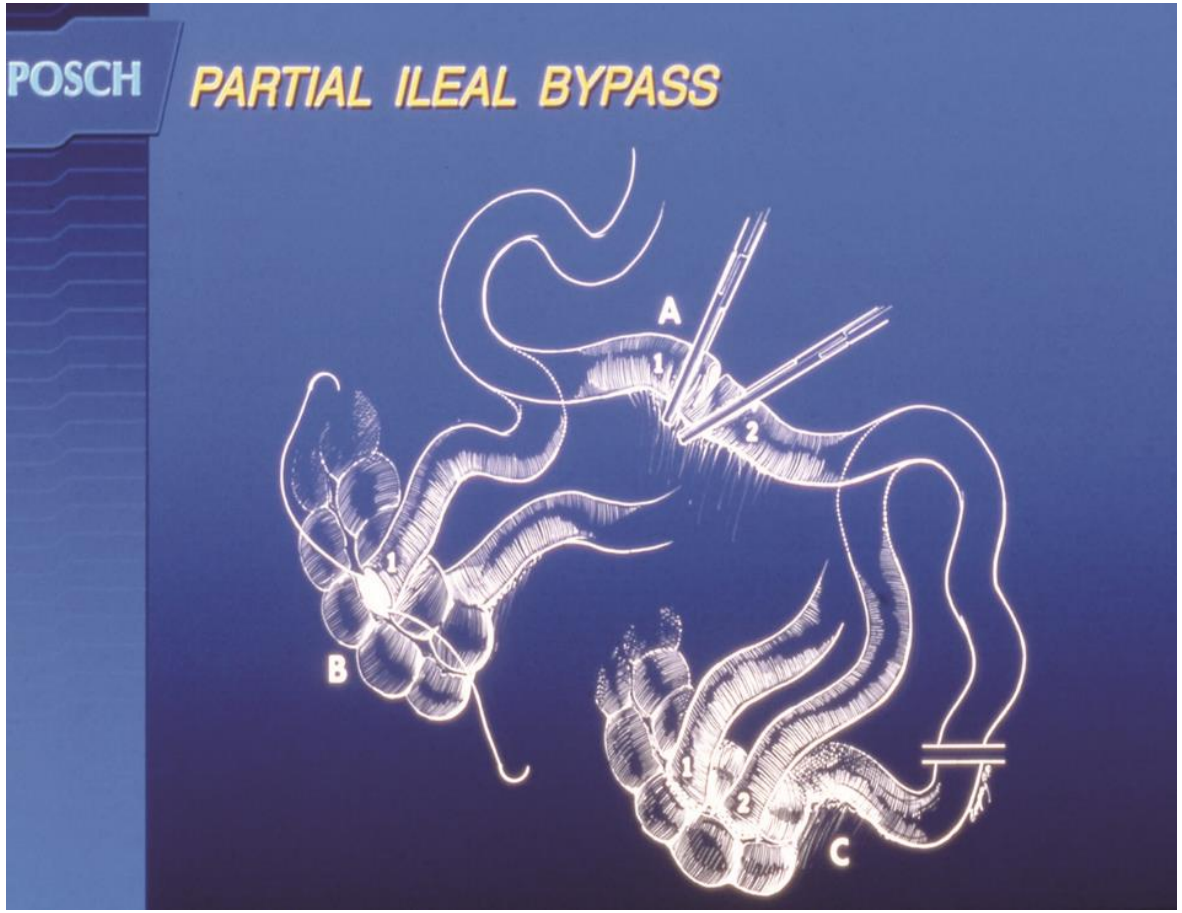
Buchwald and Varco: Metabolic Surgery, Grune and Stratton, 1978

PAST EXAMPLES OF METABOLIC SURGERY

19th Century:
Bilateral oophorectomy for metastatic breast cancer.

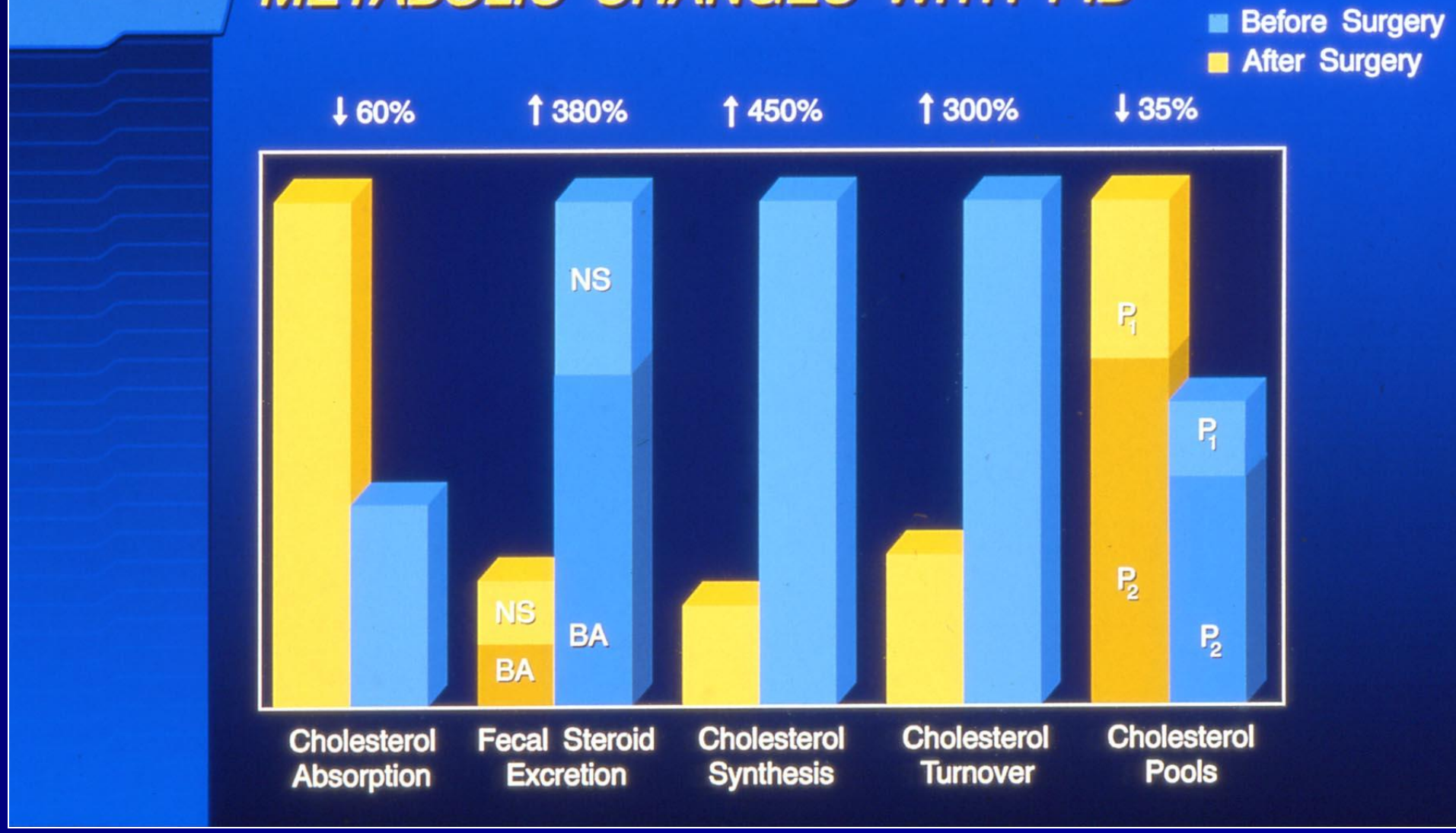
20th Century:
- Splenectomy for Idiopathic Thrombocytopenia Purpura and other hematologic diseases
- Portal diversion for Glycogen Storage Disease and Juvenile Gaucher's Storage Disease
- Adrenalectomy for Cushing's Syndrome Hypertension
- Pancreas Transplantation for Type 1 Diabetes
- Hypophysectomy for diabetic retinopathy
- Cerebral stimulation and ablation for various disorders, e.g., Parkinsonism
- Pulsing electromagnetic current stimulation for bone repair

PARTIAL ILEAL BYPASS: 1962; Program on the Surgical Control of the Hyperlipidemias (POSCH) 1990


POSCH
PARTIAL ILEAL BYPASS
A
1
2
B
1
C
1
2

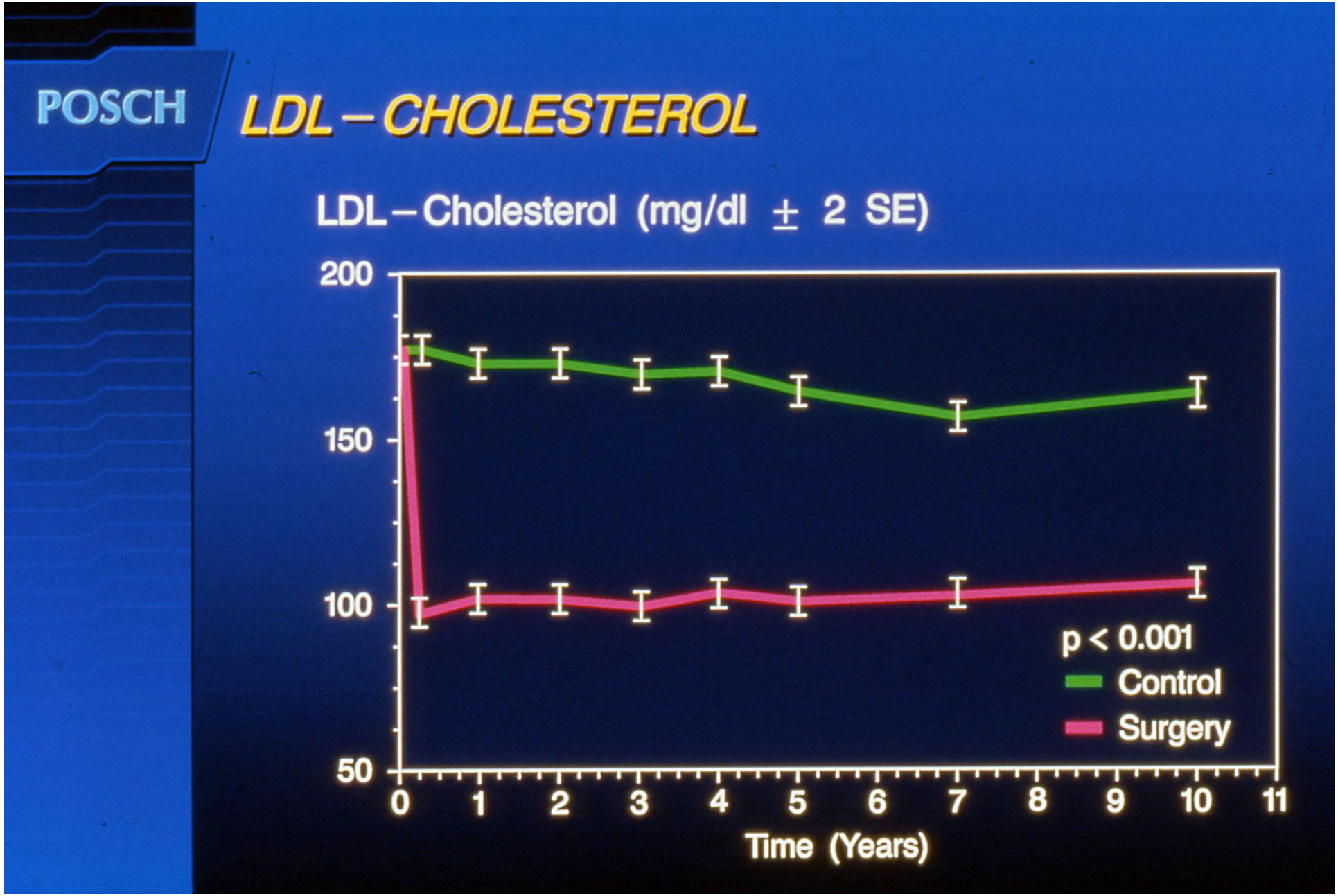
POSCH

METABOLIC CHANGES WITH PIB



POSCH

LDL – CHOLESTEROL

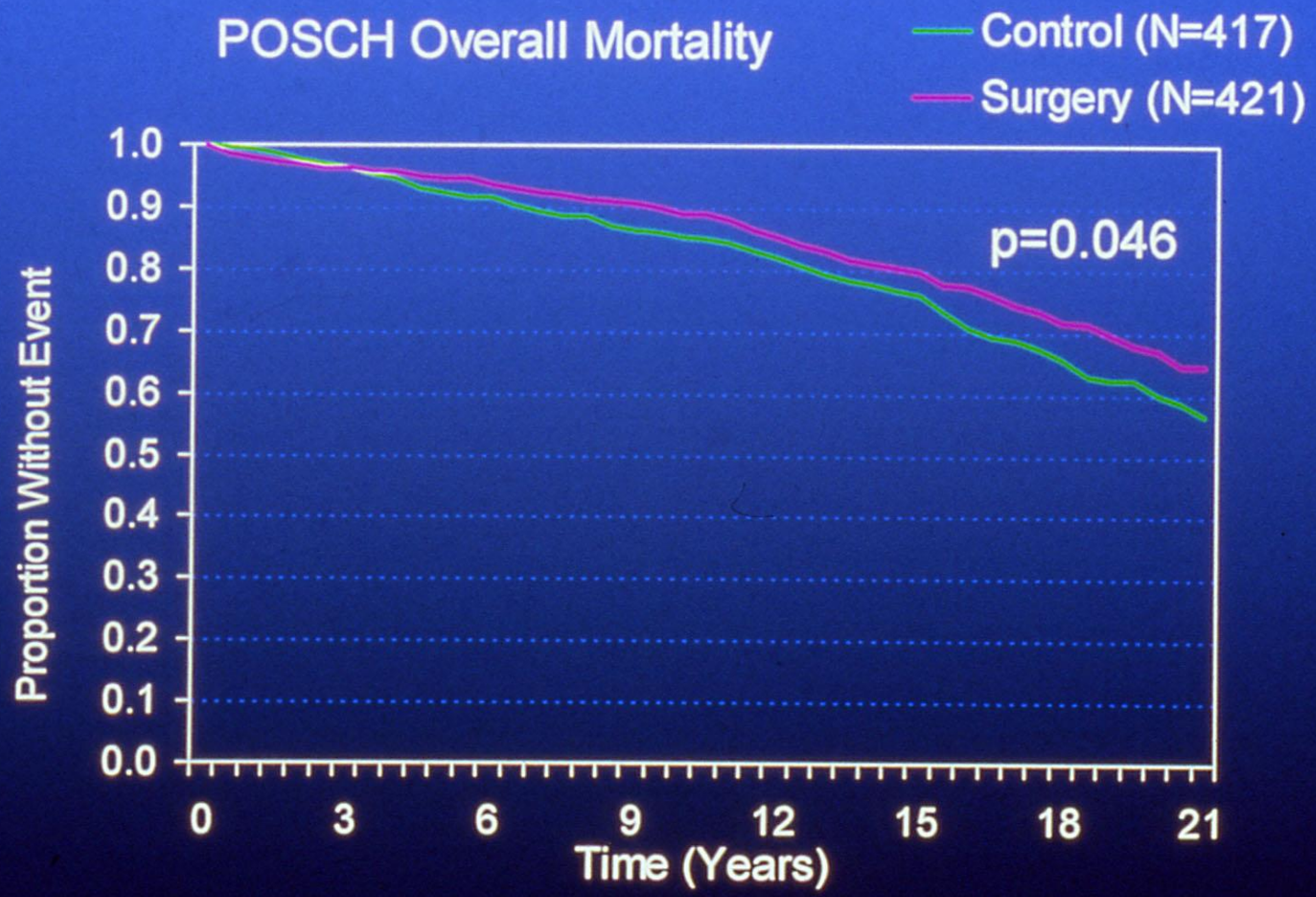


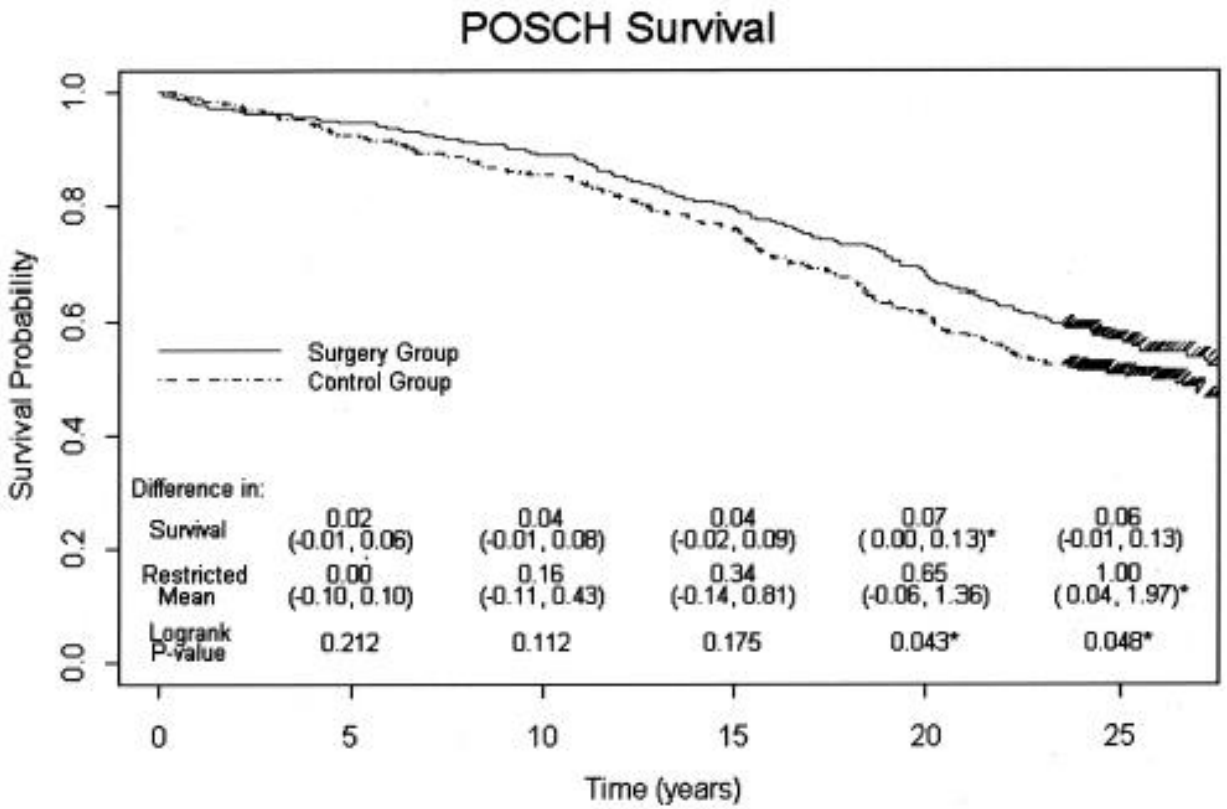
First Report of Results (July 19, 1990) ACS – October 8, 1990

Endpoint	% Difference Control/ Intervention Group	p-Value
ACHD Mortality & Nonfatal MI	35.0	< 0.001
Nonfatal MI	40.4	< 0.001
↓ CABG & PTCA	60.1	< 0.001
Overall Mortality, Ejection Fraction ≥50	36.0	0.050
ACHD Mortality	28.0	0.133
Overall Mortality	21.7	0.164

POSCH

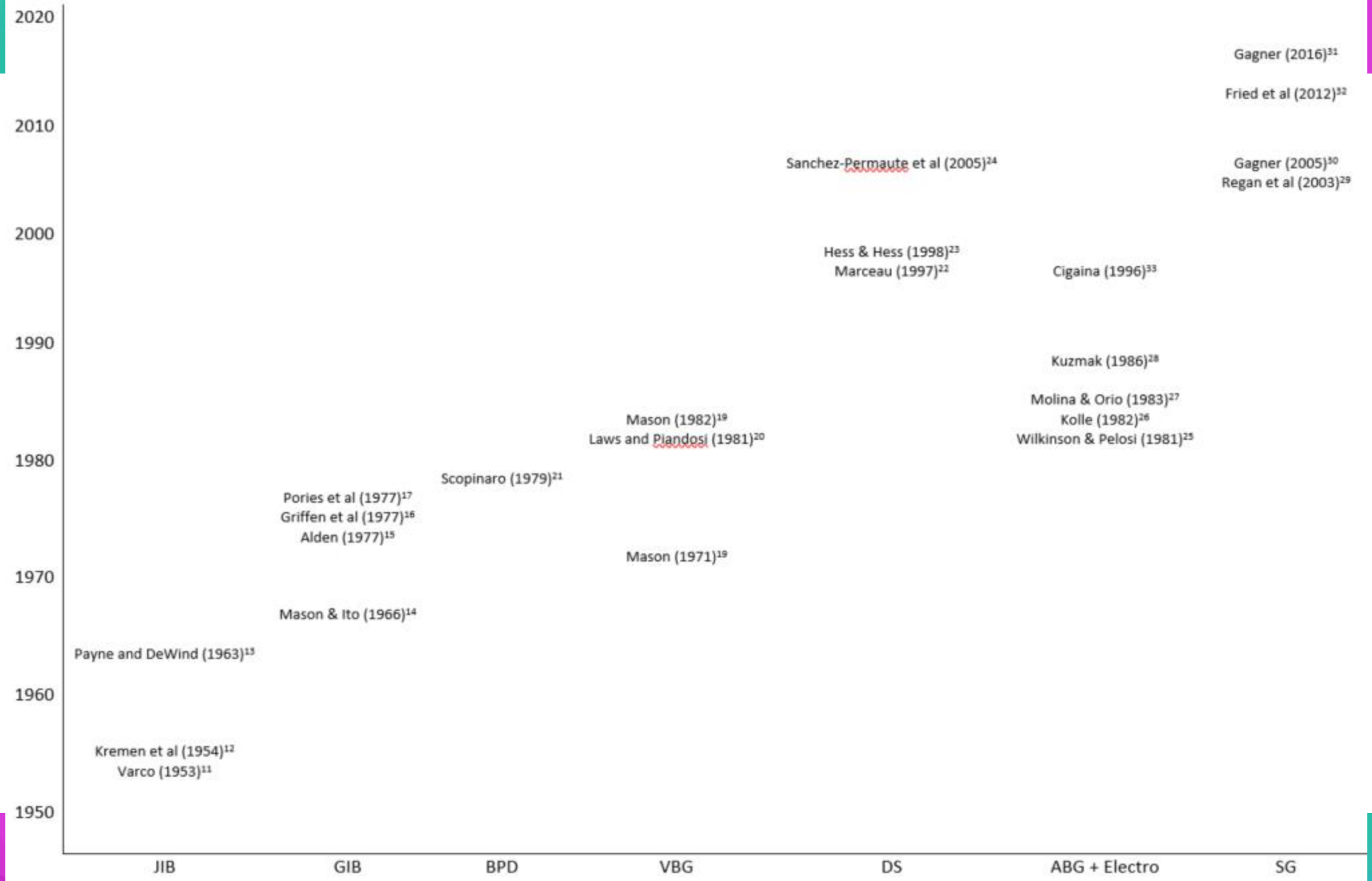
Overall Mortality
Kaplan-Meier Survival





At risk:						
Surgery Group	421	399	376	336	286	144
Control Group	417	386	357	317	256	133
Survival Probability:						
Surgery Group	1.00	0.95	0.89	0.80	0.68	0.57
Control Group	1.00	0.92	0.85	0.76	0.61	0.51

BARIATRIC SURGERY: 1953: RICHARD L. VARCO, UNIVERSITY OF MINNESOTA


2020
2010
2000
1990
1980
1970
1960
1950
Gagner (2016)[31]
Fried et al (2012)[32]
Sanchez-Permaute et al (2005)[24]
Gagner (2005)[30]
Regan et al (2003)[29]
Hess & Hess (1998)[23]
Marceau (1997)[22]
Cigaina (1996)[33]
Kuzmak (1986)[28]
Molina & Orio (1983)[27]
Mason (1982)[19]
Kolle (1982)[26]
Laws and Piandosi (1981)[20]
Wilkinson & Pelosi (1981)[25]
Scopinaro (1979)[21]
Pories et al (1977)[17]
Griffen et al (1977)[16]
Alden (1977)[15]
Mason (1971)[19]
Mason & Ito (1966)[14]
Payne and DeWind (1963)[13]
Kremen et al (1954)[12]
Varco (1953)[11]
JIB
GIB
BPD
VBG
DS
ABG + Electro
SG

METABOLIC BENEFITS OF BARIATRIC SURGERY

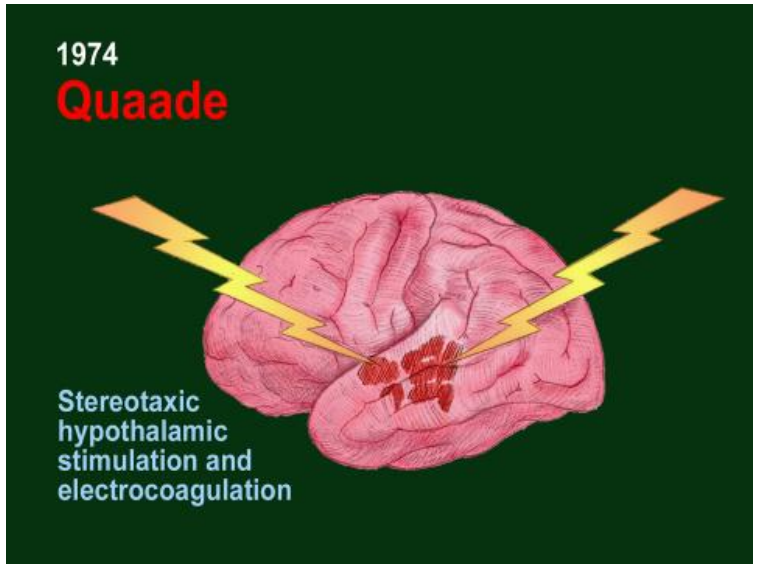
- Metabolic Syndrome Reversal: Type 2 Diabetes, Hypertension, Hyperlipidemia, plus Obesity
- Cardiovascular Disease
- NASH
- Structural: Sleep Apnea, Orthopedic
- Endocrine
- Cancer

OFFICIAL RECOGNITION THAT BARIATRIC SURGERY IS METABOLIC SURGERY

2007: American Society of Bariatric Surgery → American Society for Metabolic and Bariatric Surgery (ASMBS)

2007: International Federation for Obesity → Added… “and Metabolic Disease”

NEW HORIZONS: BRAIN STIMULATION FOR OBESITY



Quaade electrically stimulated the lateral hypothalamus with moderate success

Quaade F, Vaernet K, Larsson S. Stereotaxic stimulation and electrocoagulation of the lateral hypothalamus in obese humans. Acta Neurochir (Wien). 1974;30(1-2):111-7.

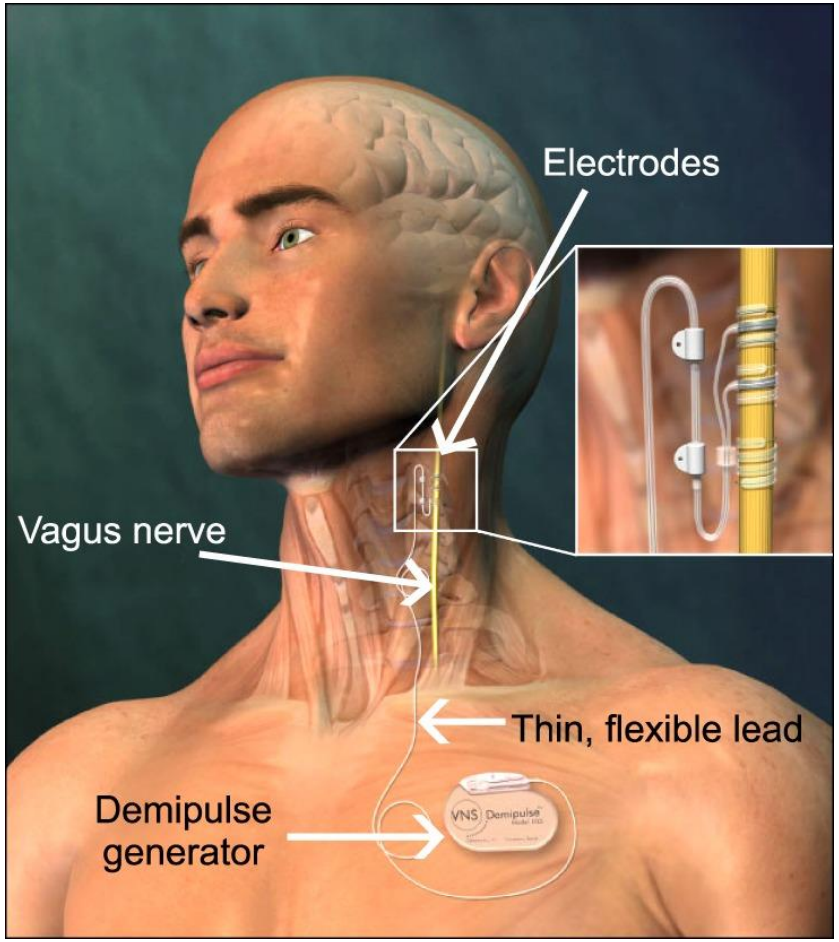
219: Review of attempts in various areas of the brain to influence metabolic diseases.

Formolo et al. Deep Brain Stimulation for Obesity: A Review and Future Directions. Front Neurosci. 2019 Apr 18;13:323.

NEW HORIZONS: BRAIN AND VAGAL STIMULATION FOR DEPRESSION

Modulated Chronic Depression by stimulation of the subgenual gyrus
2005: Mayberg et al. Deep brain stimulation for treatment-resistant depression. Neuron. 2005 Mar 3;45(5):651-60.

Single vagal nerve stimulation by an implanted vagal collar wired to an implanted pacer
2017: Carreno FR, Frazer A. Vagal Nerve Stimulation for Treatment-Resistant Depression. Neurotherapeutics. 2017 Jul;14(3):716-727.

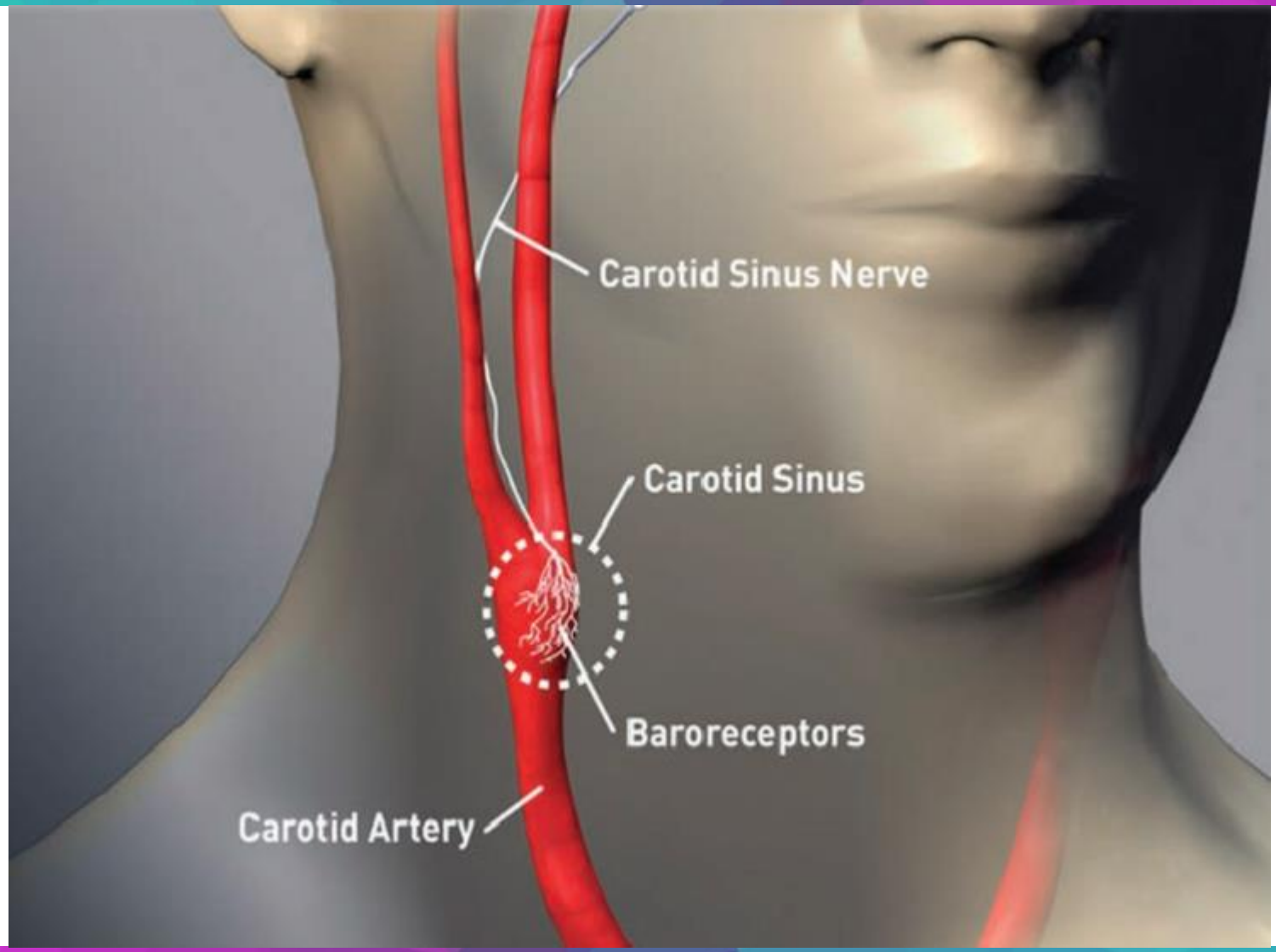

Electrodes
Vagus nerve
Thin, flexible lead
Demipulse generator
VNS Demipulse

NEW HORIZONS: CAROTID SINUS STIMULATION FOR HYPERTENSION

Both carotid sinuses are simultaneously stimulated by electrodes in the perivascular space connected to a pulse generator containing a minicomputer to control the radiofrequency impulses.

Zhang J, Zhou S, Xu G. Carotid baroreceptor stimulation: a potential solution for resistant hypertension. Interv Neurol. 2014 May;2(3):118-22.

Jordan J, Tank J. Electrical carotid sinus stimulation may get lost in translation. Hypertens Res. 2020 Oct;43(10):1122-1124.

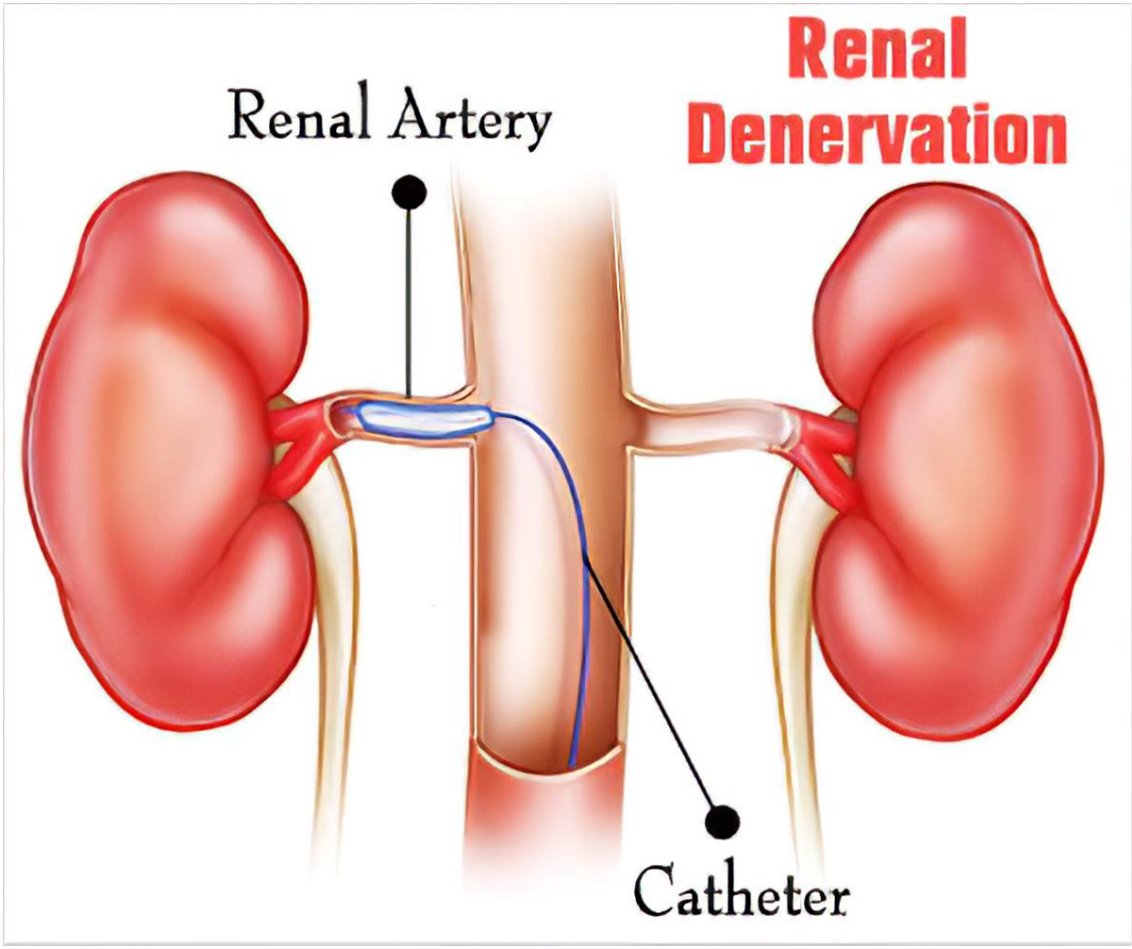

Carotid Sinus Nerve
Carotid Sinus
Baroreceptors
Carotid Artery

NEW HORIZONS: PERIRENAL VASCULAR SYMPATHETIC ABLATION FOR TYPE 2 DIABETES

Serendipity is the mother of invention.

Bilateral renal sympathetic neuroablation via a femoral artery normalized blood glucose, serum insulin, C-peptide, and HOMA-IR

2011: Mahfoud et al. M. Effect of renal sympathetic denervation on glucose metabolism in patients with resistant hypertension: a pilot study. Circulation. 2011 May 10;123(18):1940-6.


Renal Artery
Renal Denervation
Catheter

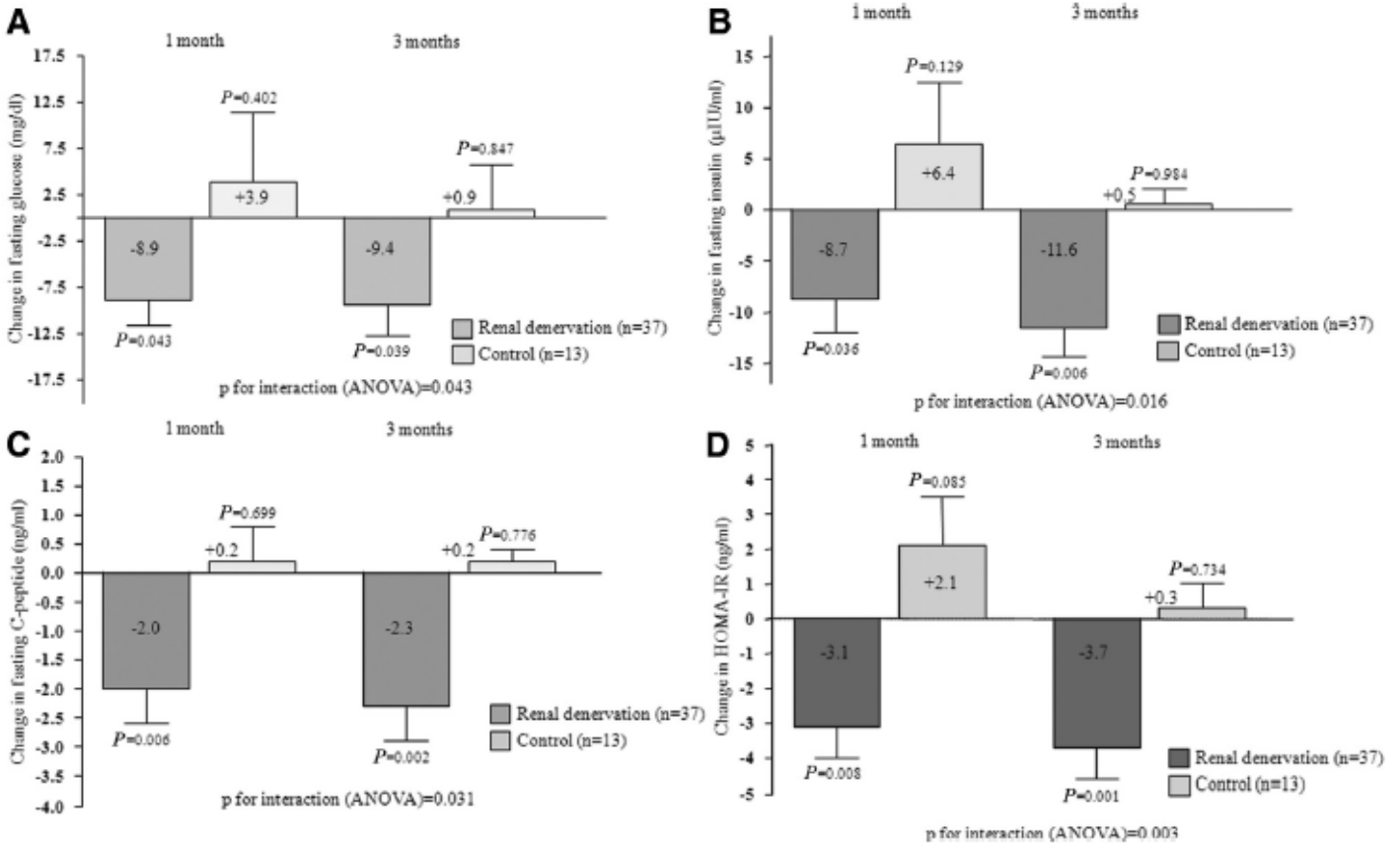
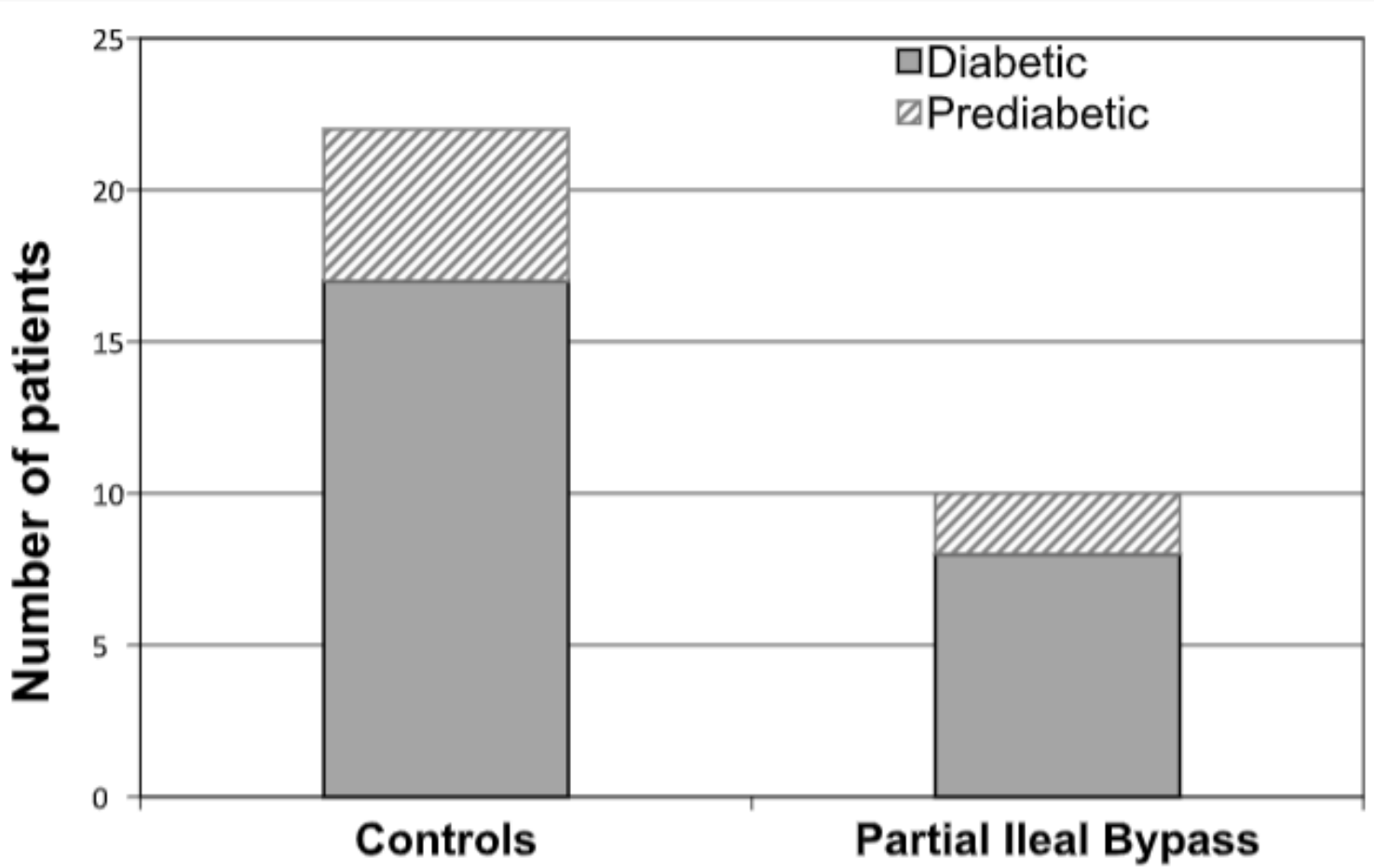


Figure 2. Change (SEM) in fasting glucose (**A**), fasting insulin (**B**), C-peptide (**C**), and homeostasis model assessment–insulin resistance (HOMA-IR; **D**) at 1 and 3 months compared with baseline. *P* values refer to change compared with baseline. Between-group effects, measured by 2-way repeated measures ANOVA, are given as *P* for interaction.

NEW HORIZONS: PARTIAL ILEAL BYPASS FOR TYPE 2 DIABETES:

Review of the POSCH data at 34 years post-trial showed a 2.5 protection from the development of type 2 diabetes and pre-diabetes in the partial ileal bypass intervention group in comparison to the controls. Can this prophylactic effect of partial ileal bypass be therapeutic; if so, a 1-day surgery could “cure” hyperlipidemia and type 2 diabetes with no further need for lifelong lifestyle and drug therapy.

Buchwald H, Oien DM, Schieber DJ, Bantle JP, Connett JE. Partial ileal bypass affords protection from onset of type 2 diabetes. Surg Obes Relat Dis. 2017 Jan;13(1):45-51.


Diabetic
Prediabetic
Number of patients
25
20
15
10
5
0
Controls
Partial Ileal Bypass

NEW HORIZONS: BARIATRIC SURGERY (SLEEVE GASTRECTOMY) FOR TRAUMATIC BRAIN INJURY (TBI) AND EARLY CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE)

Obesity and TBI are reciprocally related – concussion trauma is most likely to lead to TBI in the obese, and the obese are more likely to develop symptoms of TBI.

McGlennon TW, Buchwald JN, Pories WJ, Yu F, Roberts A, Ahnfeldt EP, Menon R, Buchwald H. Bypassing TBI: Metabolic surgery and the link between obesity and traumatic brain injury - a Review. Part 1: Obes Surg. 2020 Dec;30(12):4704-14; Part 2: Obes Surg. 2021 Jan;31(1):26-35; Part 3: Obes Surg. 2021 Feb;31(2):477-480.

After Metabolic/Bariatric surgery in an obese population there is improvement in the neurocognitive manifestations of TBI and in its associated radiologic findings.

Marques et al. J Clin Endocrinol Metab (2014). PMID: 25157409/DOI: 10.1210/jc.2014-2068
Thiara et al. Psychosomatics (2017). PMID: 28410777/DOI: 10.1016/j.psym.2017.02.004
Alosco et al. Am J Surg (2014). PMID: 24119892/DOI: 10.1016/j.amjsurg.2013.05.018

CONCLUSIONS

- Open and laparoscopic traditional incisional, extirpative, and reconstructive disciplines of surgery are giving way to pharmaceutical, endoscopic, and transvascular therapy.

- Metabolic surgery may become the mainstay discipline of surgery.

- Metabolic, currently metabolic/bariatric, surgeons can become the leaders of this transition in disciplines, as well as the research leaders in the elucidation of the metabolic mechanisms of disease.