Short- and longterm outcome after bariatric surgery:
A critical appraisal by an anesthesiologist.

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UZ Leuven
KUL
Belgium

Disclaimer.

A View from the Head End
Medical cartoons to ease the pain

By Steve Yentis
Disclaimer.

Limited experience with bariatric surgery.
I’m a so-called “obstetric” anaesthetist.
I have no financial interest in the matter.
Why was I persuaded to give a “critical” appraisal?

Relatives/friends who have undergone surgery.
The observation of pregnancy complications

Relatives and friends ……
Relatives and friends ……

BMI: 31

Biliopancreatic Bypass with Duodenal Switch

2 years later

R.I.P. Rest in Peace You are missed so much
Pregnancy related complications.

Fetal Cerebral Hemorrhage Caused by Vitamin K Deficiency After Complicated Bariatric Surgery

Tim Van Mieghem, MD,
Dominique Van Schoubroeck, MD, Marc Depiere, MD,
Anne Debeer, MD, and Myriam Hanssens, MD, PhD

From personal experience to science.....

- Pubmed search October 21st 2009: « bariatric surgery »
- 9583 papers spanning 31 years.
Mission impossible

Most papers are flawed.

Most papers only short term outcome.

Most papers compare with untreated patients.

Very few good papers remain……
Hence a flawed/biased lecture ....

Outline

- Obesity: the problem.
- Outcome after bariatric surgery.
- Some issues to consider.
- Conclusions.

 Obesity: a frightening problem.

- Obesity increases the occurrence of other problems:
  - Diabetes.
  - Coronary artery disease.
  - Lipid disorders.
  - Gall bladder problems.
  - Degenerative cartilage problems.
  - AHT.
  - Congestive heart failure.
  - Obstructive sleep apnea syndrome.
  - Pulmonary Hypertension.
  - CVA.
  - Cancer.

Frequency and severity ~ BMI

Cancer.
Classification according to WHO.

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI</th>
<th>Risk of comorbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
<td>Low (but risk of other clinical problems increased)</td>
</tr>
<tr>
<td>Normal range</td>
<td>18.50–24.99</td>
<td>Average</td>
</tr>
<tr>
<td>Overweight</td>
<td>≥ 25.00</td>
<td>Increased</td>
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<tr>
<td>Preobese</td>
<td>25.00–29.99</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 30.00</td>
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<tr>
<td>Obese class I</td>
<td>30.00–34.99</td>
<td>Moderate</td>
</tr>
<tr>
<td>Obese class II</td>
<td>35.00–39.99</td>
<td>Severe</td>
</tr>
<tr>
<td>Obese class III</td>
<td>≥ 40.00</td>
<td>Very severe</td>
</tr>
</tbody>
</table>

BMI, body mass index.
*a* When BMI is over 50 this is sometimes referred to as 'super-obesity'.

Obesity in adult Americans

BRFSS, 2006

(*BMI ≥30, or ~30 lbs. overweight for 5' 4" person*)
Europe.

**Obesity:** The percentage of the population older than 15 with a body mass index greater than 30.

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>USA</td>
<td>24%</td>
</tr>
<tr>
<td>Mexico</td>
<td>23%</td>
</tr>
<tr>
<td>UK</td>
<td>21%</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>20%</td>
</tr>
<tr>
<td>Greece</td>
<td>20%</td>
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<tr>
<td>Australia</td>
<td>20%</td>
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<tr>
<td>New Zealand</td>
<td>21%</td>
</tr>
<tr>
<td>Hungary</td>
<td>19%</td>
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<tr>
<td>Czech Republic</td>
<td>19%</td>
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<tr>
<td>Canada</td>
<td>16%</td>
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<tr>
<td>Spain</td>
<td>15%</td>
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<tr>
<td>Ireland</td>
<td>13%</td>
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<tr>
<td>Germany</td>
<td>13%</td>
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<tr>
<td>Portugal</td>
<td>10%</td>
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<tr>
<td>Finland</td>
<td>10%</td>
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<td>Turkey</td>
<td>10%</td>
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<td>Belgium</td>
<td>10%</td>
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<tr>
<td>Finland</td>
<td>10%</td>
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<tr>
<td>Netherlands</td>
<td>10%</td>
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<tr>
<td>Sweden</td>
<td>12%</td>
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<tr>
<td>Denmark</td>
<td>10%</td>
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<tr>
<td>France</td>
<td>9%</td>
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<tr>
<td>Austria</td>
<td>9%</td>
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<tr>
<td>Italy</td>
<td>8%</td>
</tr>
<tr>
<td>Norway</td>
<td>8%</td>
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<tr>
<td>Japan</td>
<td>3%</td>
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<tr>
<td>Korea</td>
<td>3%</td>
</tr>
</tbody>
</table>

**Obesity and health risks**

Wei et al. JAMA 1999; 282, 1547 – 1553.
Advantages of weight loss: 10 kg loss.

- Systolic blood pressure:
  - 10 mmHg decrease in Syst BP.
  - 20 mmHg decrease in Diast BP.

- Angina:
  - 91% reduction in symptoms.
  - 33% increase in work tolerance.

- Lipid profile:
  - 10% decrease in cholesterol.
  - 15% decrease in LDL-cholesterol.
  - 30% decrease in triglycerides.
  - 8% increase in HDL-cholesterol.

- Diabetes:
  - >50% reduction in the risk to develop diabetes.
  - 30 – 50% decrease in glycemia levels.

Bariatric surgery: rescue therapy.

Bariatric surgery.

- Restrictive procedures.
- Malabsorptive operations.
- Mixed procedures.

Mechanisms of action ??????

Multiple variations !!!!!

Pories W.J. J Clin Endocrinol Metab 2008; 93, S89-S96.

Effects of bariatric surgery.

- Weight.
- Co-morbidities.
- Quality of life.
How is weight loss expressed?

- % initial weight loss: % of initial weight that is lost.
- Decrease in BMI.
- % excess weight loss: % of the initial excess weight (above ideal weight) that is lost.

Example:
- Ideal weight is 60 kg.
- Initial weight is 90 kg.
- Stable weight is 72 kg.
- \( \Rightarrow \) % IWL = 20% and % EWL = 60%.
Adjustable Gastric Banding and Conventional Therapy for Type 2 Diabetes

A Randomized Controlled Trial

Figure 2: Percentage of Weight Loss Achieved Over the 2-Year Study Period (p<0.01) and Individual Weight Measures at Baseline and at 2 Years. Data markers with error bars indicate mean ±SD.

60 patients.
5 lost to follow-up.

Weight loss and diabetes remission improved in the surgical group.


Treatment of Mild to Moderate Obesity with Laparoscopic Adjustable Gastric Banding or an Intensive Medical Program

A Randomized Trial

Paul E. O’Brien, MD; John R. Dixon, MBBS, FRCP; Cheryl Lawrie, RN; Stewart Skinner, MBBS, FRCP; Joe Puglielli, MBBS, FRCP; John McNiel, MBBS, MD, FRCP; Boyd Strauss, MBBS, FRCP; Sharon Marks, MBBS, FRCP; Linda Schachter, MBBS; Leon Chapman, MBBS; and Margaret Anderson, BHM

Table 2. Estimated Weight, Body Mass Index, and Percentage of Excess Weight Loss at Baseline and at 4, 12, 18, and 24 Months on the Basis of Longitudinal Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>4 mos</th>
<th>12 mos</th>
<th>18 mos</th>
<th>24 mos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>93.2 (4.8)</td>
<td>85.2 (5.4)</td>
<td>81.2 (4.8)</td>
<td>80.2 (4.6)</td>
<td>80.2 (4.6)</td>
</tr>
<tr>
<td>BMI</td>
<td>35.1 (4.4)</td>
<td>32.0 (5.1)</td>
<td>30.9 (4.7)</td>
<td>30.4 (4.7)</td>
<td>30.4 (4.7)</td>
</tr>
<tr>
<td>Weight %</td>
<td>10.9 (1.3)</td>
<td>15.2 (2.0)</td>
<td>21.8 (2.6)</td>
<td>22.1 (2.6)</td>
<td>22.1 (2.6)</td>
</tr>
</tbody>
</table>

Values are mean (SD). P-values are for the difference between groups. COX models were used for longitudinal analysis, with age, sex, and baseline weight as covariates. *p < 0.05, †p < 0.01.

80 patients.
Weight loss and quality of life improved

Sex hormone-binding globulin levels and cardiovascular risk factors in morbidly obese subjects before and after weight reduction induced by diet or malabsorptive surgery

G. Mingrone a,*, A.V. Greco a, A. Giancaterini a, A. Scarfone a, M. Castagneto b, M. Pugaz a

- 79 subjects.
- Malabsorptive surgery vs diet.
- Only 1 year follow up.
- Good weight loss.
- But residual weight still BMI > 30.

Table 1

<table>
<thead>
<tr>
<th>Physical characteristics of the subjects studied</th>
<th>Weight (kg)</th>
<th>BMI (kg/m²)</th>
<th>FFM (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women: operated (79)</td>
<td>112.2 ± 24.3</td>
<td>41.6 ± 8.6</td>
<td>49.5 ± 5.8</td>
</tr>
<tr>
<td>Men: operated (79)</td>
<td>149.2 ± 26.1</td>
<td>47.8 ± 8.8</td>
<td>57.3 ± 11.4</td>
</tr>
<tr>
<td>Women: non-operated (70)</td>
<td>125.0 ± 12.2</td>
<td>45.9 ± 8.4</td>
<td>53.7 ± 11.6</td>
</tr>
</tbody>
</table>


Changes of Body Weight and Plasma Ghrelin Levels after Gastric Banding and Gastric Bypass

Rolf Stoekl, Robin Chanda, Igor Langer, and Ulrich Keller

- 13 operated
- 7 non-operated
- 2 years of follow-up.

Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects

Lars Sjöström, M.D., Ph.D., Kristina Narbro, Ph.D., C. David Sjöström, M.D., Ph.D., Kristjan Karason, M.D., Ph.D., Bo Larsson, M.D., Ph.D., Hans Wedel, Ph.D., Ted Lysetig, Ph.D., Marianne Sullivan, Ph.D., Claude Bouchard, Ph.D., Björn Carlsson, M.D., Ph.D., Calle Bengtsson, M.D., Ph.D., Sven Dahlgren, M.D., Ph.D., Anders Gunnarsson, M.D., Peter Jacobsson, M.D., Ph.D., Jan Karlsson, Ph.D., Anna‐Karin Lindroos, Ph.D., Hans Lönnroth, M.D., Ph.D., Ingmar Näslund, M.D., Ph.D., Torsten Olbers, M.D., Ph.D., Kaj Stenlöf, M.D., Ph.D., Jair Torgerson, M.D., Ph.D., Göran Ågren, M.D., and Lena M.S. Carlsson, M.D., Ph.D., for the Swedish Obese Subjects Study

- Matched controls cohort study
- Surgery: 2010 patients
- No surgery: 2037 patients
- Surgery: miscellaneous types of intervention
- Conventional treatment:
  - Often nothing.
  - Sometimes sophisticated lifestyle interventions.
- Mean follow-up of almost 11 years (4-18 years)

Long-term survival after gastric bypass or conventional therapy: retrospective cohort.

Limited gain in survival rates.
More non-disease related deaths after surgery.
Most gain in survival in the morbidly obese group.
Effects of bariatric surgery….
Some remarks.

- Limited prospective, randomized, controlled evidence:
  - Only 219 patients prospectively randomized and published.
  - Only ± 4200 patients in large well-designed cohort studies.
  - Only one study: follow-up for >10 years.
  - Significant weight loss, but BMI remains pathologic.
  - At ten years beneficial effects of surgery are attenuated.
  - Patient survival only just significantly better (p=0.04). And what about better medical management in more modern days?
  - Control patients: poorly followed.
  - What if standardized and intensive/sophisticated conventional treatment would have been the standard?


Operative mortality.

- Buchwald et al. JAMA 2004:
  - 0.1% mortality after gastric banding.
  - 0.5% mortality after gastric bypass.
  - 1.1% mortality after biliopancreatic diversion.

<table>
<thead>
<tr>
<th>Table 2. SRC data from 272 ASMBS Centers of Excellence with 495 surgeons reporting outcomes in more than 110,000.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital mortality:</td>
</tr>
<tr>
<td>Operative mortality at 30 d (76 + 89 = 165):</td>
</tr>
<tr>
<td>Operative mortality at 90 d (76 + 89 + 31 = 196):</td>
</tr>
<tr>
<td>Readmissions</td>
</tr>
<tr>
<td>Reoperations</td>
</tr>
</tbody>
</table>

Data are based on applications.

Operative mortality: 0.1 – 1.1 %

Major adverse events: ± 5%

Perioperative Safety in the Longitudinal Assessment of Bariatric Surgery

The Longitudinal Assessment of Bariatric Surgery (LABS) Consortium

Table 2. Adverse Outcomes within 30 Days after Surgery, According to Surgical Procedure.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total (N = 408)</th>
<th>Laparoscopic Adjustable Gastric Banding (N = 116)</th>
<th>Laparoscopic Roux-en-Y Gastric Bypass (N = 207)</th>
<th>Open Roux-en-Y Gastric Bypass (N = 85)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>15 (3.7)</td>
<td>0</td>
<td>6 (2.8)</td>
<td>9 (2.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Deep vein thrombosis or venous thromboembolism</td>
<td>20 (4.9)</td>
<td>3 (2.6)</td>
<td>12 (5.8)</td>
<td>5 (5.9)</td>
<td>0.09</td>
</tr>
<tr>
<td>Tracheal intubation</td>
<td>20 (4.9)</td>
<td>2 (1.7)</td>
<td>12 (5.8)</td>
<td>6 (7.1)</td>
<td>0.004</td>
</tr>
<tr>
<td>Kidney injury</td>
<td>34 (8.3)</td>
<td>5 (4.3)</td>
<td>24 (11.7)</td>
<td>5 (5.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tracheotomy</td>
<td>33 (8.1)</td>
<td>0</td>
<td>6 (2.9)</td>
<td>5 (5.9)</td>
<td>0.001</td>
</tr>
<tr>
<td>Placement of percutaneous drain</td>
<td>14 (3.5)</td>
<td>0</td>
<td>13 (6.3)</td>
<td>5 (5.9)</td>
<td>0.18</td>
</tr>
<tr>
<td>Abdominal operation</td>
<td>118 (29.0)</td>
<td>5 (3.9)</td>
<td>94 (45.6)</td>
<td>13 (15.3)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Failure to be discharged by day 30</td>
<td>17 (4.2)</td>
<td>0</td>
<td>15 (7.2)</td>
<td>4 (4.7)</td>
<td>0.02</td>
</tr>
<tr>
<td>Composite end point</td>
<td>189 (46.3)</td>
<td>12 (9.6)</td>
<td>143 (69.1)</td>
<td>34 (39.5)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

* The table includes 364 procedures, including 217 sleeve gastrectomies, 47 biliopancreatic diversion with or without a duodenal switch, 5 vertical banded gastroplasty, and 1 open adjustable gastric banding.

** P values are for the comparison between treatment groups. Values were calculated with the use of the chi-square test.

*** This end point is a composite of death, deep-vein thrombosis or serious venous thromboembolism, reintervention with the use of a percutaneous, endoscopic, or operative technique, or failure to be discharged from the hospital within 30 days after surgery.
Complication requiring reoperation | N (%) | Interval (months)
--- | --- | ---
Pouch dilation | 11 (27) | 35 (1 – 98)
Band leakage | 4 (10) | 31 (8 – 82)
Intragastral band migration | 2 (5) | 65 (38 – 92)
Perforation of esophagus | 2 (5) | 10 days
Port disconnection | 2 (5) | 2009; 5, 218 - 223.

41 patients
Laparoscopic gastric banding procedures
Obesity and pregnancy.

Table 4. Odds ratios (OR) or adjusted odds ratios (AOR) and 95% confidence interval of fetal complications, comparing infants of obese women with infants of pregant women with a BMI of 20-25 kg m⁻².

<table>
<thead>
<tr>
<th></th>
<th>Preterm delivery</th>
<th>Stillbirth</th>
<th>Prenatal death</th>
<th>Macrosomia</th>
<th>Iatrogenic care</th>
<th>Hypo-glycemia</th>
<th>Jaundice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callewaert et al. (25)</td>
<td>AOR 0.95</td>
<td>AOR 1.19</td>
<td></td>
<td></td>
<td>AOR 1.29</td>
<td></td>
<td>AOR 0.99</td>
</tr>
<tr>
<td>(0.76-1.19)</td>
<td>(0.66-2.55)</td>
<td></td>
<td></td>
<td></td>
<td>(0.57-1.62)</td>
<td></td>
<td>(0.68-1.79)</td>
</tr>
<tr>
<td>Cody et al. (14)</td>
<td>AOR 2.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(1.28-3.33)</td>
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<td></td>
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<tr>
<td>Noutkouwer et al. (13)</td>
<td>AOR 1.12</td>
<td>AOR 2.36</td>
<td></td>
<td></td>
<td>AOR 1.19</td>
<td></td>
<td>AOR 1.30</td>
</tr>
<tr>
<td>(0.80-1.06)</td>
<td>(1.38-4.02)</td>
<td></td>
<td></td>
<td></td>
<td>(1.17-1.60)</td>
<td></td>
<td>(1.10-1.60)</td>
</tr>
<tr>
<td>Kristensen et al. (17)</td>
<td>AOR 3.1</td>
<td>AOR 2.7</td>
<td></td>
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<tr>
<td>(1.6-5.9)</td>
<td>(1.2-4.1)</td>
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<tr>
<td>Ehrenberg et al. (22)</td>
<td></td>
<td>AOR 1.6</td>
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<tr>
<td>(1.4-1.8)</td>
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<tr>
<td>Bo et al. (37)</td>
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</tr>
<tr>
<td>Janssen et al. (37)</td>
<td>OR 1.6</td>
<td>OR 1.0</td>
<td></td>
<td></td>
<td>OR 1.6</td>
<td></td>
<td>OR 1.0</td>
</tr>
<tr>
<td>(0.5-2.9)</td>
<td>(0.2-1.3)</td>
<td></td>
<td></td>
<td></td>
<td>(1.3-2.2)</td>
<td></td>
<td>(0.4-1.7)</td>
</tr>
<tr>
<td>Nucci et al. (96)</td>
<td>AOR 0.99</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>(0.7-1.3)</td>
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</tbody>
</table>

Bariatric surgery and pregnancy.

- ↑ incidence of small for gestational age children.
- ↑ incidence of Intrauterine growth restriction.
- ↑ birth defects and perinatal mortality ?????
- More mechanical problems due to the growing uterus.
- Sometimes limited maternal weight gain.
- Vitamine deficiencies and catastrophic fetal/neonatal outcome.
Bariatric surgery and pregnancy.

At least 14 reported cases of serious intestinal problems during pregnancy in just a few years.

Guelinckx et al. Obesity Rev 2008; 9, 140 - 150.

Bariatric surgery and vit. K deficiency and the fetus.


KCE report volume 36A.

US: 31% obesity  
Belgium 12% obesity 

Cost in Belgium: €15,000,000 in 2004!  
This is the cost without readmission / Reintervention / complication management.


- Studies support cost/effectiveness of bariatric surgery!
- But:
  - Limited long-term outcome data.
  - Control treatment poorly defined.
  - Results in specialized centers ≠ real life.
  - <BMI: no real outcome data.

Original article
The ASBS Bariatric Surgery Centers of Excellence program: a blueprint for quality improvement
Gary M. Pratt, B.S.*, Byron McLees, Ph.D., M.D.*, Walter F. Parks, M.D., F.A.C.S.**
*Department of Surgery, The Cleveland Clinic Foundation, Cleveland, Ohio
**Department of Surgery, The Cleveland Clinic Foundation, Cleveland, Ohio
Received Jan 10, 2005; revised Feb 7, 2005; accepted Feb 10, 2005.

- Centers of excellence:
  - Uniform guidelines.
  - Outcome database.
  - Rigorous application process.
  - Complete, pre-, per- and postoperative system in place.
  - Minimum number of procedures: 125 annually.


Belgium.

- 30% has enough volume

KCE report volume 36A.
Conclusions (1).

- Bariatric surgery is superior to conventional therapy 2 years after intervention in terms of:
  - Weight loss.
  - Reduction of co-morbidity.

- However, results are less clear when therapy is evaluated 10 years after intervention. Much of the weight loss has re-occurred.
Conclusions (2).

- Paucity of prospective, randomized trials with long-term follow-up.
- Standard therapy: extremely variable and poorly controlled.
- Government should invest money in prevention and studying conventional therapy.

Conclusions (3).

- BMI < 35: too early to conclude it is safe and more effective than conventional therapy.
- Decision to operate: multidisciplinary team.
- Importance of « centers of excellence »
  - A system and multidisciplinary team.
  - Sufficient volume.
In conclusion, it is a sobering fact that some obese young adults may lose up to 20 years of life expectancy if they do not reduce their weight. The price tag for treating obesity and related conditions is daunting. One must treat obesity aggressively, though thoughtfully, and with an eye toward developing effective prevention and better therapies that ideally would eliminate the need for surgery altogether. But until we get to that point, the weight of the evidence indicates that bariatric surgery is safe, effective, and affordable.

The demonstration of long-term benefits of bariatric surgery is encouraging but must be viewed in a broad context. The increasing prevalence of obesity not only in adults but also in children and adolescents — indeed, bariatric surgery is now being considered a potential pediatric intervention — indicates the urgent need to implement effective preventive interventions, beginning early in life, to improve dietary habits and increase physical activity. Bariatric surgery is currently the most successful approach to "rescuing" patients with severe obesity and reversing or preventing the development of several diseases associated with obesity. It would be an even greater success to make these procedures unnecessary.