Bariatric surgery

Remission or Cure for Diabetes?

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Obesity

.. Condition in which body fat has accumulated to such an extent that health may be adversely affected (WHO, 2000)
Edmonton Obesity Staging System (EOSS)

**STAGE 0**
- NO sign of obesity-related risk factors
- NO physical symptoms
- NO psychological symptoms
- NO functional limitations

Case Example:
Physically active female with a BMI of 32 kg/m², no risk factors, no physical symptoms, no self-esteem issues, and no functional limitations.

**STAGE 1**
- Patient has obesity-related **SUBCLINICAL** risk factors (borderline hypertension, impaired fasting glucose, elevated liver enzymes, etc.) - OR -
- MILD physical symptoms - patient currently not requiring medical treatment for comorbidities (dyspnea on moderate exertion, occasional aches/pains, fatigue, etc.) - OR -
- MILD obesity-related psychological symptoms and/or mild impairment of well-being (quality of life not impacted)

Case Example:
38-year-old female with a BMI of 59.2 kg/m², borderline hypertension, mild lower back pain, and knee pain. Patient does not require any medical intervention.

**STAGE 2**
- Patient has an **ESTABLISHED** obesity-related co-morbidities requiring medical intervention (HTN, Type II Diabetes, sleep apnea, PCOS, osteoarthritis, reflux disease) - OR -
- MODERATE obesity-related psychological symptoms (depression, eating disorders, anxiety disorder) - OR -
- MODERATE functional limitations in daily activities (Quality of life is beginning to be impacted)

Case Example:
32-year-old male with a BMI of 36 kg/m² who has primary hypertension and obstructive sleep apnea.

**STAGE 3**
- Patient has **SIGNIFICANT** obesity-related end-organ damage (myocardial infarction, heart failure, diabetic complications, incapacitating osteoarthritis) - OR -
- **SIGNIFICANT** obesity-related psychological symptoms (major depression, suicide ideation) - OR -
- **SIGNIFICANT** functional limitations (eg, unable to work or complete routine activities, reduced mobility)
- **SIGNIFICANT** impairment of well-being (quality of life is significantly impacted)

Case Example:
49-year-old female with a BMI of 67 kg/m² diagnosed with sleep apnea, CV disease, GERD, and suffered from stroke. Patient’s mobility is significantly limited due to osteoarthritis and gout.

**STAGE 4**
- **SEVERE** (potential end stage) from obesity related co-morbidities - OR -
- **SEVERELY** disabling psychological symptoms - OR -
- **SEVERE** functional limitations

Case Example:
45-year-old female with a BMI of 54 kg/m² who is in a wheelchair because of disabling arthritis, severe hyperpnoea, and anxiety disorder.

**WHO CLASSIFICATION OF WEIGHT STATUS (BMI kg/m²)**
- Obese Class I: 30 - 34.9
- Obese Class II: 35 - 39.9
- Obese Class III: ≥40

Stage 0 / Stage 1 Obesity
Patient **does not meet clinical criteria for admission** at this time. Please refer to primary care for further preventative treatment options.

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Sharma AM & Kushner RF, Int J Obes 2009
Why do people gain weight?

• Metabolic
• Hormonal
• Psychological
• Social
• Genetics
• Drug induced
Medical Complications of Obesity

- Pulmonary disease:
  - abnormal function
  - obstructive sleep apnea
  - hypoventilation syndrome

- Nonalcoholic fatty liver disease:
  - steatosis
  - steatohepatitis
  - cirrhosis

- Gall bladder disease

- Gynecologic abnormalities:
  - abnormal menses
  - infertility
  - polycystic ovarian syndrome

- Osteoarthritis

- Skin

- Gout

- Idiopathic intracranial hypertension

- Stroke

- Cataracts

- Coronary heart disease:
  - Diabetes
  - Dyslipidemia
  - Hypertension

- Severe pancreatitis

- Cancer:
  - breast
  - uterus
  - cervix
  - colon
  - esophagus
  - pancreas
  - kidney
  - prostate

- Phlebitis:
  - venous stasis
Control of Appetite

![Diagram showing the control of appetite with hormones and the hypothalamus and brain stem involved.]

- Adiposity signals: Insulin, Leptin
- Gut Hormones: OXM, PYY, Ghrelin, CCK, GLP-1, PP
- Vagus Nerve links the hypothalamus and brain stem.
Natural History of Type 2 Diabetes

Obesity

IGT*

Diabetes

Uncontrolled Hyperglycemia

- Post-Meal Glucose
- Fasting Glucose
- Insulin Resistance
- Insulin Secretion

*IGT = impaired glucose tolerance.

Adapted from International Diabetes Center (IDC), Minneapolis, Minnesota.
Glucoregulatory Role of Incretins

GLP-1 secreted upon the ingestion of food

β-cells: Enhances glucose-dependent insulin secretion

Promotes satiety and reduces appetite

α-cells: ↓ Postprandial glucagon secretion

Liver: ↓ Glucagon reduces hepatic glucose output

Stomach: Helps regulate gastric emptying

Types of Bariatric Surgery

- Adjustable Gastric Band
- Sleeve Gastrectomy
- Gastric Bypass
- Gastric balloon
- POSE
- Endobarrier
- VGBLOC
Remission of Diabetes?

Defined as:

• Fasting plasma glucose below 7 mmol/L in the absence of medical treatment for at least 3 days.

• A 2-hour plasma glucose below 11.1 mmol/L following an OGTT.

• HbA1c below 6% after 3 months of last hypoglycemic agent usage.
Bariatric surgery and Glycaemic control

1. Hypotheses for Diabetic Control through Bariatric Surgery
   • Foregut hypothesis
   • Hind gut hypothesis

2. Bariatric surgery and appetite regulating hormones
   
   **PYY**
   • Increased fasting & meal stimulated PYY levels following RYGB & sleeve gastrectomy
   • Increased postprandial PYY in RYGB but normal in gastric banding

   **Gherilin**
   Mixed results on ghrelin levels post bariatric surgery

   **Leptin**
   Leptin levels unchanged post RYGB and sleeve gastrectomy
Bariatric surgery and Glycaemic control

3. Bariatric surgery and Incretin hormones

Increased GLPM1 by a factor of 5 one month post RYGB

Postprandial GLP-1 increased following RYGB but unchanged following gastric banding

Persistent post prandial increases of GLP-1 20 years after duodeno-jejunal bypass

4. Glycaemic control through weight loss

Achieved within days to months after operation, before major weight loss

i. Biliopancreatic diversion / duodenal switch = 95%
ii. RouxMenMY gastric bypass = 80%
iii. Gastric banding = 57%
Gastric balloon
An adjustable prosthesis is placed at the upper part of the stomach. The stoma of the prosthesis is calibrated with saline introduced via a subcutaneous access port. (Diagram courtesy of Johnson and Johnson Medical.)
Mode of action of Gastric banding

- Band is placed at top of stomach which creates a small pouch
- Reduction in intake, quicker and longer satiety
- Proposed that compression of vagal afferent nerves in band area mediates satiety effect (O’Brien, 2010)
- Activation of peripheral satiety mechanism without physically restricting meal size (Burton & Brown, 2011)
Gastric Sleeve

Vertical Sleeve Gastrectomy (VSG)
Sleeve Gastrectomy

70% of Stomach removed
Mode of Action of Sleeve

• Restrictive
• Alters hormone signals from stomach to brain
• BMI >40kg/m² or BMI >35kg/m² with co-morbidities that could be improved with weight loss

• All appropriate non surgical measures have failed to achieve clinically significant weight loss

• Intensive management in specialist obesity service

• Commit to the need for long term follow up

• Fast track for people with BMI >50kg/m²
No alcoholism or major psychiatric illness

• Need to be abstinent

• Consult a psychiatrist if necessary
  – Schizophrenia, borderline personality, active suicidal ideation, uncontrolled depression (absolute contraindications)
Evidence

- **Swedish Obese Subjects - Mortality**: up to 40% lower risk over 10 years (Sjöström et al., 2007)

- **Diabetes**: >70% remission after 2 years (in recently diagnosed) (Sjöström et al., 2004) (Dixon et al., 2008)
Bariatric Surgery and Diabetes

• Meta-analysis (Buchwald et al – 2009)
  
  Overall remission rate of 78%
  
  • < 2 years since surgery 80%
  • >2 years since surgery 75%
  • Results seen with all operations, yet most dramatic with the gastric bypass

If treated within 5 years of Diabetes diagnosis—higher long term remission rates (Brethauer et al, 2013)
Bypass and Diabetes

• Bypass shows more promising resolution of diabetes than the sleeve or band.

  Parikh et al (2013)—Meta-analysis (1389pts)
    – Remission rates (1 year):
      • 33% Lap band
      • 54% Sleeve
      • 64% Gastric Bypass

• Buchwald et al (2009)
  – Resolution of T2DM
    • 57% Lap band patients
    • 80% Gastric bypass patients
Bypass and Diabetes

• Unique to bypass—Diabetes resolution can come before weight loss

  – Bypassing a short segment of proximal intestine directly ameliorates T2DM, independent of food intake, body weight, etc.
  – Potentially undiscovered factors from proximal small bowel contributing to pathophysiology of DM
LAGB and Diabetes

• Sultan et al (2010: SOARD 6:373-376.)
  – 102 patients LAGB (5 year mean EWL 48.3%)
  – 88% preop on meds for DM, 46.5% on @5yrs
  – 14.9% preop on insulin for DM, 8.5% @ 5yrs
  – HbA1c: 7.53 avg preop; 6.58 avg 5 yrs later
  – DM resolved in 40% of LAGB at 5 years
  – Combined improvement/remission rate was 80% at 5 years
LAGB and Diabetes

  – Remission improvement rates varied from 53-70% within 2 years after LAGB placement
Restrictive Procedures and Diabetes

Bariatric procedures have been shown to be superior to conservative therapy in the management of Type 2 diabetes

Long term Remission

Association of Bariatric Surgery With Long-term Remission of Type 2 Diabetes and With Microvascular and Macrovascular Complications

Lars Sjöström et al

Ideal candidate for diabetes remission

• High insulin and/or high glucose at baseline predicted favourable treatment effects
• High baseline BMI predicts poor outcome
• Increased rate of diabetes remission with higher C-peptide levels
• Shorter duration of diabetes
• Lower HbA1C
• Insulin independence
Benefits of Bariatric surgery

• BP reduction
• Reduced risk of cancer
• Improved quality of life
• Improved exercise tolerance
• Reduced cardiovascular risk
• Improvement in sleep apnoea
• Improvement in fertility
• Increased confidence and self-esteem
1. Acid-base disorder
2. Bacterial overgrowth (primarily with BPD, BPD/DS)
3. Pseudo-obstruction
4. Nocturnal diarrhea
5. Proctitis
6. Acute arthralgia
7. Electrolyte abnormalities (primarily with BPD, BPD/DS) Low Ca, K, Mg, Na, P
8. Arrhythmia, myopathy
9. Enteral or parenteral repletion
10. Fat-soluble vitamin deficiency Vitamin A—night vision
11. Vitamin D—osteomalacia
12. Vitamin E—rash, neurologic
13. Vitamin K—coagulopathy
14. Folic acid deficiency Hyperhomocysteinemia
Metabolic complications of bariatric surgery

15. Anaemia
16. Foetal neural tube defects
17. Osteoporosis Fractures
18. Oxalosis Kidney stones
19. Secondary hyperparathyroidism
20. Vitamin D deficiency
21. Thiamine deficiency Wernicke–Korsakoff encephalopathy
22. Beriberi
23. Vitamin B12 deficiency Neuropathy
24. Zinc deficiency
25. Selenium deficiency
Other complications

- Post operative worsening of retinopathy
- Recurrent hypoglycaemia leading to cognitive impairment
- Nesidioblastoma
Spot the difference
Summary

• Remission of Type 2 and not Type 1 diabetes can be expected with Bariatric surgery.

• Prolonged duration of disease has been associated with poorer remission rates of diabetes after bariatric surgery.

• Even if Type 2 diabetes remission is achieved patients should be followed yearly with HbA1C and should have retinal screening done.