Bariatric and Metabolic Surgery

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Contents

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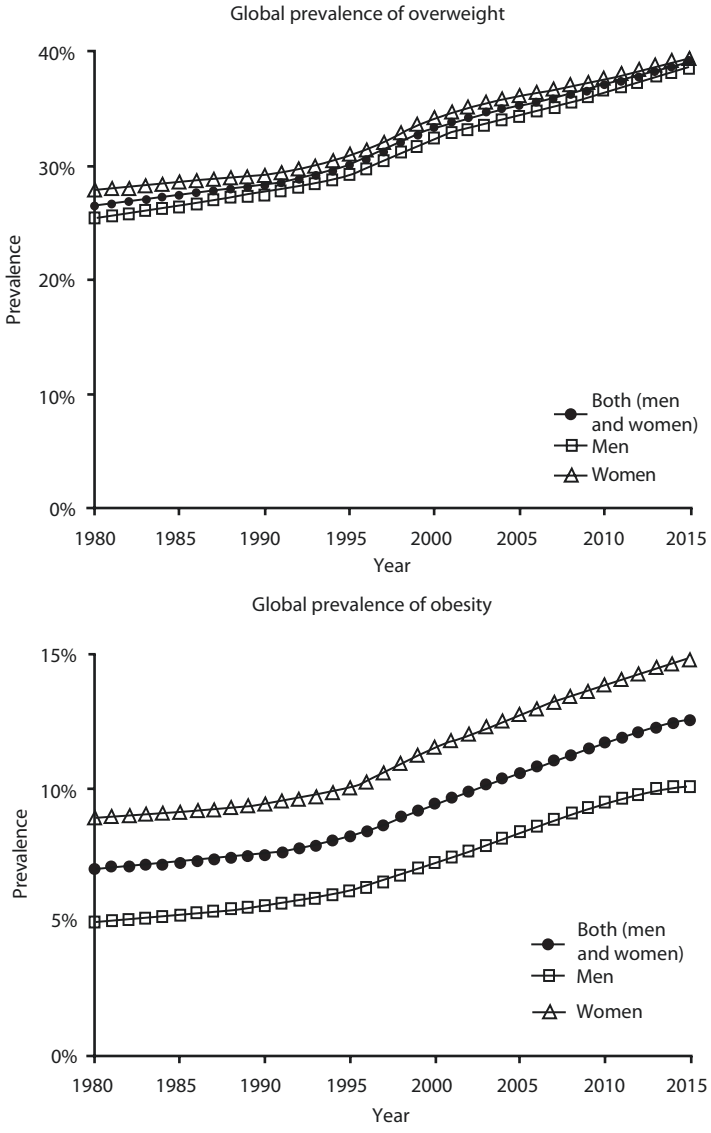
7.1 Epidemiology

7.1.1 Incidence

- Obesity = epidemic worldwide
- Obesity definition:
  - Overweight (preadiposity): BMI (Body Mass Index) = 25–29.9
  - Obesity grade 1: BMI = 30–34.9
  - Obesity grade 2: BMI = 35–39.9 ("severe obesity")
  - Obesity grade 3: BMI ≥ 40 ("morbid obesity")
  - "Superobesity": BMI ≥ 50
- Obesity in USA:
  - Prevalence increase 15.3% of population (1995), 23.9% (2005), 27.2% (2010), 39.8% (2016)
  - 4.8% with BMI > 35, 3.7% with BMI > 40
  - Prevalence development (◘ Figs. 7.1 and 7.2)
- Obesity worldwide (WHO data 2016):
  - Delayed increase
  - approx. 13% of the population obese; 39% overweight



◘ **Fig. 7.1** Age-standardized overall prevalence of overweight (upper curve) and obesity (lower curve) in men and women (age > 20 years) (during 1980–2015). (From Chooi et al. 2019; courtesy of Chooi et al.)

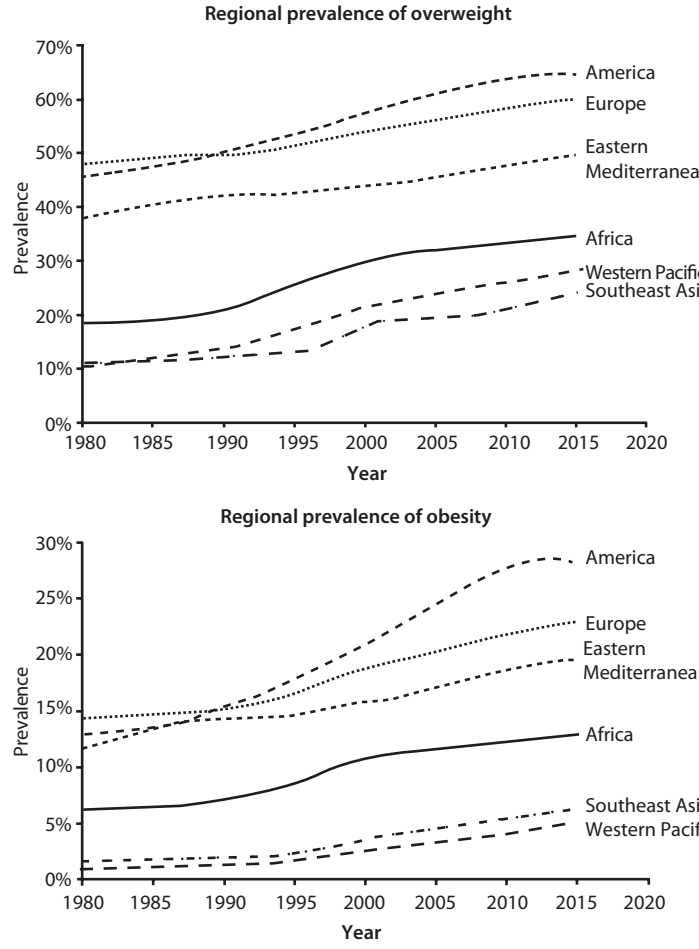


Fig. 7.2 Age-standardized regional prevalence of overweight (upper curve) and obesity (lower curve) in men and women (age > 20 years) (over the period 1980–2015). (From Chooi et al. 2019; courtesy of Chooi et al.)

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7.1.2 Health Economic Consequences

- Obesity-associated morbidity (especially abdominal obesity): Increased risk of
  - Arterial hypertension
  - Type-2 diabetes mellitus
  - Hyperlipidemia
  - Sleep Apnea Syndrome
  - Coronary heart disease, steatosis hepatis and myocardial infarction
- Costs associated with obesity:
  - Compared to normal weight: 30% higher costs in obese patients, 81% higher costs in morbidly obese patients
  - 147 billion $ annually in the USA (2008)
  - 420,000 deaths in 2016 in U.S.

7.2 Pathophysiology and Principle of Action of Bariatric Surgery

Key Points

- Pathophysiology of obesity = complex + not completely understood
- Operating principle of bariatric surgery:
  - Gastric Restriction
  - Intestinal malabsorption
  - Learned behavioral changes
  - Neural and endocrine signal change (postoperative)

7.2.1 Pathophysiology

- Complex and not completely understood
- Contributing factors:
  - Genetic factors (approx. 67% of BMI variability)
  - Behavioural factors (decrease in physical activity, increase in intake of high calorie food)
  - Psychological factors
  - Other, e.g. economic, socio-educational factors

7.2.2 Working Principle of Bariatric Surgery

- Bariatric surgery = altering the anatomy of the GI tract: reducing caloric intake
- Simplified: 3 operating methods/principles:
  - Restrictive methods
  - Hormonal (hypoabsorptive) methods
  - Combined methods (restrictive + hormonal)
- In reality: active principle of bariatric surgery = complex and interaction of:
  - Gastric Restriction
  - Intestinal hypoabsorption
  - Learned behavioural changes (e.g. after excessive food intake following gastric restriction: nausea and vomiting lead to adaptation of eating habits)
  - Neural and endocrine signal change (postoperative)
    - For example, gastric bypass: suppression of grhelin secretion leads to a reduction in appetite
  - Other hormones with implications after bariatric surgery: cholecystokinin, peptide YY, GLP (*glucagon-like peptide*)-1

Restrictive Methods

- Principle of action of the gastric pouch: By reaching the feeling of satiety early + delayed gastric emptying to limit food intake (volume limitation)
- Basic principle of the operation: Formation of a small gastric reservoir with reduced outflow
- surgical procedures (◘ Fig. 7.3):
  - Gastroplasty (e.g. sleeve gastrectomy)
  - Gastric Balloon Insertion
  - Laparoscopic gastric plication (new method under study)
  - Endoscopic Sleeve Gastroplasty
- Historical method: adjustable gastric banding ("vertical banded gastroplasty")

Hypoabsorptive Methods

- Active principle: Limitation of nutrient uptake
- Basic principle of the operation: forming a bypass of different portions of the small intestine
- surgical procedures (◘ Fig. 7.3): Currently no purely hypoabsorptive method
- Historical methods: Purely hypoabsorptive methods
- For example, jejunoileal bypass.

Combined Methods

- Principle of action: Limitation of food intake (volume limitation) + Limitation of nutrient intake
- Basic principle of the operation: formation of a small gastric reservoir with reduced outflow + formation of a bypass of different portions of the small intestine
- Surgical procedures (◘ Fig. 7.3):
  - Proximal Roux-Y-Gastric Bypass
  - "Banded Gastric Bypass"
  - Biliopancreatic diversion with/without duodenal switch
  - Mini gastric bypass (new method under study)
  - "single anastomosis duodeno-ileal bypass with sleeve gastrectomy" (SADI-S); (new method under study)

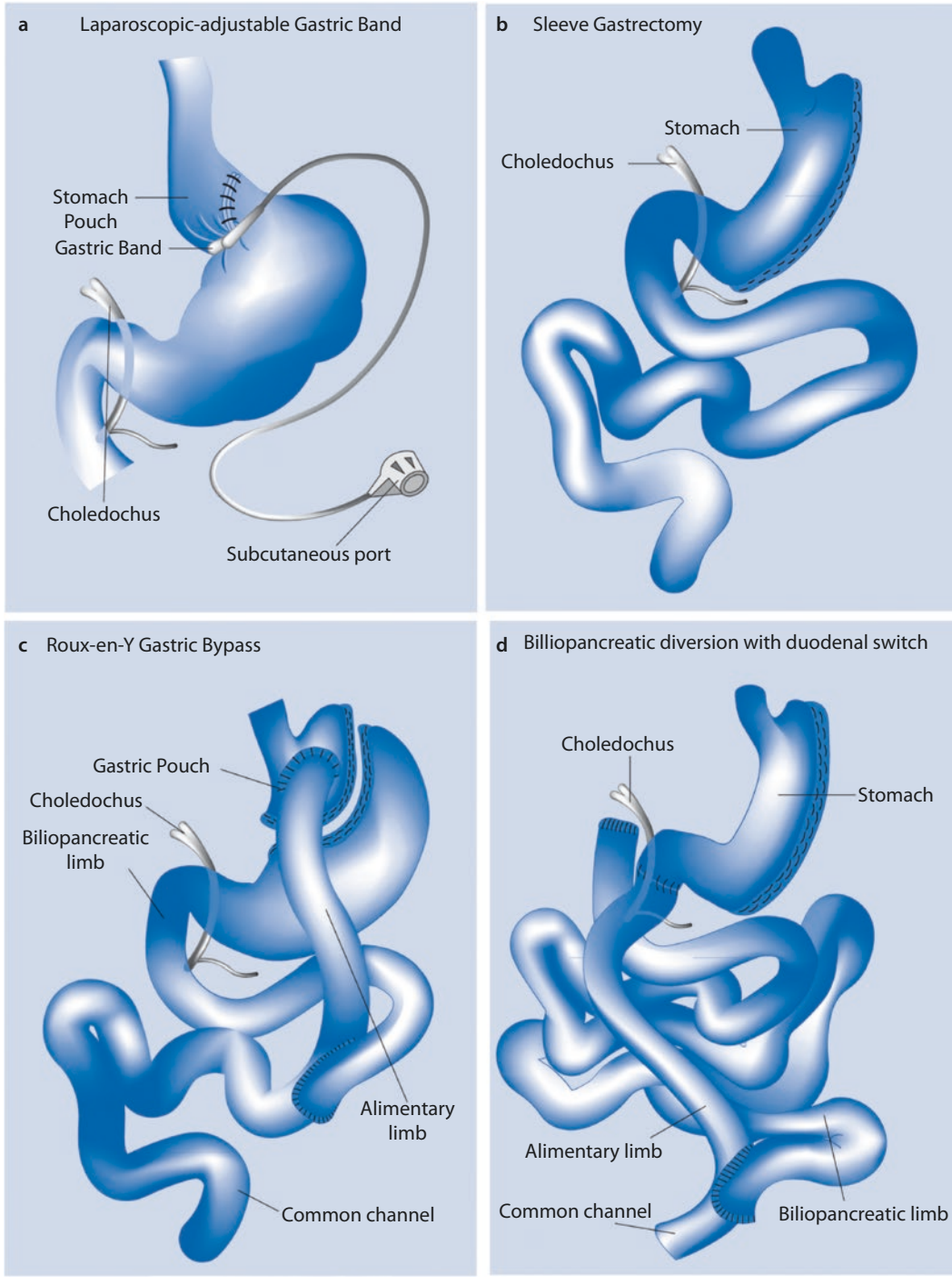

Fig. 7.3 **a–d** Currently most frequent specific bariatric interventions

7.3 Clinical Evidence

7.3.1 Bariatric Surgery: Laparoscopic Versus Open

- Reduced postoperative pain
- Reduction of morbidity:
  - In particular, fewer pulmonary complications
  - Fewer incisional hernias
  - Fewer wound complications (infections, wound healing disorders)
- Reduction of hospital stay
- Faster recovery time

7.3.2 Bariatric Surgery: Prospective Controlled Studies

- No large randomized trial comparing bariatric surgery vs. medical therapy
- Only 2 small randomized trials +3 cohort studies (all at high risk for bias) + meta-analyses:
  - Bariatric surgery: weight loss on average = 20–50 kg
  - Non-surgical therapy: Minimal weight loss
- A large prospective controlled case-control study (Swedish SOS study; Sjöström 2013):
  - Significantly better weight loss in surgery vs. non-surgery group after 2 years, and after 10 years
  - Combined procedures better than purely restrictive procedures
  - Median BMI decrease at 2 years after bariatric surgery: 50.0 (combined) to 32.6 (restrictive)
  - Significantly lower morbidity after surgery (HR = 0.56; P = 0.01)
  - Significantly fewer cardiovascular events after surgery (HR = 0.83; P = 0.05)

7.3.3 Metabolic Consequences of Bariatric Surgery

- Randomized controlled trial and meta-analysis results
- Diabetes mellitus:
  - Diabetes remission: 0% after no surgery vs. 22.4% after surgical therapy (after 5 years)
  - Diabetes-associated medication use: no treatment after 5 years: 0% after no surgical vs. 45% after surgical therapy
  - Effects independent of BMI at baseline
- Hyperlipidemia: treatment of 83% of patients
  - NAFLD/NASH: improvement steatosis index/fibrosis index (tubular stomach better than gastric bypass) (Billmann et al. 2021)
- Arterial hypertension: treatment of 66% of patients
- Sleep apnea: treatment of 88% of patients
- Improvement of end organ damage (especially those linked to Type-2 diabetes; e.g. diabetic kidney disease)

7.3.4 Mortality: Bariatric Surgery Versus Drug Therapies

- Matched case control studies only
- Last-published large study (Aminian et al. 2019): significantly lower all-cause mortality in the surgery Group (10.0%) vs. no surgery Group (17.8%)
- SOS study: Significant reduction in all-cause mortality of 31.6% in surgery group vs. non-surgery group

7.4 Specific Current Bariatric Interventions

7.4.1 Roux-Y Gastric Bypass "Gastric Bypass"

- Combined method
- Procedure basis: division of the stomach – small gastric pouch (20–30 mL); Roux-Y gastrojejunostomy + jejunojejunostomy with formation of a:
  - Biliopancreatic limb: Jejunal limb from Treitz ligament to jejunojejunostomy (confluence of biliary, pancreatic secre-

tions and alimentary flow); length = 30–100 cm
- Alimentary limb: Roux limb from gastrojejunostomy to jejunojejunostomy; the limb passes food; length = 75–150 cm
- Common channel: rest of the small intestine after jejunojejunostomy to ileocecal valve

Surgical Procedure
Roux Y Gastric Bypass
- Incision of the omentum minus 6 cm distal to the gastroesophageal junction
- Dissection dorsolaterally along the posterior wall of the stomach and finding the omental bursa
- Transsection of the stomach using the Endo-GIA device and formation of the stomach pouch (volume target of the pouch = 20 mL)
- Performing a CEEA ("circular end-to-end anastomosis") pressure plate 25 mm by means of a gastric tube through the gastric pouch; alternative = gastrojejunostomy by means of an Endo-GIA device, or completely hand-sewn
- Division of the omentum majus
- Measurement of the small intestine from Treitz ligament
- Antecolic end-to-side gastrojejunostomy by means of CEEA (device transabdominal through lumen of distal jejunum)
- Test for leakage
- Measurement of the Roux thigh and side-to-side jejunojejunostomy
- Standard lengths: Roux length = 75–100 cm; distance between Treitz ligament and jejunojejunostomy = 30–100 cm.
- Extended lengths: Roux and Treitz jejunostomy lengths 150 cm and 100 cm respectively
- Closure of mesenteric defects
- Leak-testing (not mandatory) and closure of the accesses

7.4.2 Banded Gastric Bypass

- Restrictive method
- Procedure basis: In addition to gastric bypass, a gastric band to prevent regain of weight.
- Complications: Complications of vertical banded gastroplasty (s. ► Sect. 7.6.1)

7.4.3 Laparoscopic Adjustable Gastric Banding (LAGB)

- Restrictive method
- Procedure basis: Placement of an adjustable band (connected to a subcutaneous port) approximately 1–2 cm aborally of the gastroesophageal junction and formation of a 30 mL gastric pouch

Surgical Procedure
Laparoscopic Adjustable Gastric Banding
- Placement of the tape 1 cm below the esophagogastric junction
- Formation of a tunnel for placing the ligament through the pars flaccida in the area of the small gastric curvature above the bursa omentalis
- Using an intragastric calibration probe
- Tape is left blank at the beginning
- Anterior extensive fixation of the ligament, especially at the large curvature (fundus)
- Gastrogastric sutures for fixation of the ligament below the virtual pouch, directly below the esophagogastric junction
- Port chamber placed on the rectus abdominis or epigastric muscle
- Adaptation of the band volume possible in the consultation (depending on weight loss and symptoms)

7.4.4 Biliopancreatic Diversion (BPD)

- Combined method

- Basic principle of the operation: Distal subtotal gastrectomy (50–80%) with reconstruction like gastric bypass; difference: enteroenterostomy clearly more distal with formation of a common channel of approx. 50–100 cm length

Surgical Procedure
Biliopancreatic Diversion (BPD)

- Devascularization of the large gastric curvature (mostly preservation of the gastricae-breves vessels) + first part of the duodenum
- Transection of the duodenum with stapler, after isolation and transection of the right gastric veins
- transection of the omentum minus along the small curvature up to approx. 2 cm below the left gastric veins
- Horizontal gastrectomy (residual stomach = approx. 300 mL; approx. 5 cm from cardia along the small curvature), by means of endo-GIA stapler
- Cholecystectomy
- Measure the common limb, mark 50 cm from the ileocecal valve.
- Cutting of the small intestine approx. 250 cm orally of the ileocecal valve (formation of the alimentary limb)
- Anastomosis between biliopancreatic and alimentary limb by means of side-to-side anastomosis at the level of the 50 cm marker
- Formation of a window in the mesocolon transversum and passage of the gastric stump to the submesocolic region
- Enterotomy of the distal intestinal stump and posterior gastric wall and gastroenterostomy using endo-GIA stapler
- Closure of the common defect by means of hand suture (closure of the mesenteric defects with non-absorbable suture)
- Exclusion of leakage/bleeding
- Irrigation, possibly drainage (not absolutely necessary), closure of the accesses

7.4.5 Biliopancreatic Diversion with Duodenal Switch (BPD/ DS)

- Combined method
- Basic principle of surgery: like BPD with sleeve gastrectomy and preservation of the pylorus, ileoduodenostomy behind the pylorus; alimentary limb approx. 150 cm and biliopancreatic limb (different lengths)

Surgical Procedure
Biliopancreatic Diversion with Duodenal Switch

- Devascularization of the large gastric curvature + first part of the duodenum
- Transection of the duodenum with stapler
- Vertical gastrectomy (70% of the stomach), starting 6 cm proximal to the pylorus parallel to the small curvature, using a 60 Fr.(French)-nasogastric tube (placeholder)
- Exclusion of leakage of the stapler line (after duodenoileal anastomosis)
- Measure the common limb, mark 100 cm from the ileocecal valve
- Cutting of the small intestine approx. 250 cm orally of the ileocecal valve (formation of the alimentary limb)
- Antecolic anastomosis between biliopancreatic and alimentary limb by means of side-to-side anastomosis at the level of the 100 cm marker
- Duodenoileal anastomosis end-to-side
- Closure of the common defect by means of hand suture (closure of the mesenteric defects with non-absorbable suture)
- Irrigation, possibly drainage (not absolutely necessary), closure of the accesses

7.4.6 Gastric Sleeve Resection

- Restrictive and hormonal method (especially in patients with high perioperative risk)

- Basic principle of the operation: By means of splinting (32 to 40 Fr probe) of the small curvature resection of the large gastric curvature:
  - As definitive bariatric surgery
  - In preparation for the BPD/DS
- Currently the most performed bariatric surgery worldwide

Surgical Procedure

Gastric Sleeve Resection "Sleeve Gastrectomy"

- Retraction of the liver (especially left lobe) and visualization of the pylorus and the large curvature of the stomach
- Dissection of the greater omentum to open the lesser sac
- Dissection of the large curvature (starting 2–3 cm proximal to the pylorus) and division of the short gastric vessels up to the gastroesophageal junction
- Splinting of the small curvature of the stomach by means of a thick gastric tube (approx. 36 Fr.) and vertical sleeve gastrectomy (by means of an endo-GIA stapler) starting 4 cm orally of the pylorus up to the gastroesophageal junction.
- Extraction of the resected part of the stomach
- Exclusion of leakage or bleeding along the stapler line
- Leak testing and closure of the accesses

Results Weight Loss

- 80% of gastric bypass patients achieve a weight loss of 60–80% of the excessive weight in the first year; in the longer term stabilization at 50–60% of the excessive weight
- Average weight loss: 30.19 kg for adjustable gastric band; up to 51.93 kg for BPD; after 10 years, stabilization of weight loss at 20–30 kg.
- 10–40% of patients do not achieve long-term weight loss

7.5 Complications

7.5.1 Mortality

- Between 0.1 and 2.0% in large studies
- No significant difference compared to non-op. General population (long-term study)
- In Meta-analyses:
  - After gastric bypass: 0.5%
  - After gastric banding: 0.1
  - After hypoabsorptive surgery: 1.1%

Causes of Mortality

- Pulmonary Embolism
- Anastomotic leakage and sepsis
- Myocardial Infarction
- Malignant/non-malignant neoplasms
- Ileus/gangrene due to hernias

Risk Factors

- Experience of the surgeon/department
- Advanced patient age
- Male gender
- Super obesity (BMI > 50)
- Comorbidities

7.5.2 Gastrointestinal Complications

- Relatively often

Nausea and Vomiting

- In more than 50% of patients with restrictive method
- Mostly because of dietary errors (too much, too fast)
- Anastomotic stenosis = other cause

Dumping Syndrome

- Neurohormonal syndrome
- Triggered by the ingestion of sugar
- Clinical presentation:
  - Flush phenomenon of the face and upper half of the torso
  - Drowsiness/dizziness

  - Tachycardia
  - Fatigue
  - Diarrhea
- Incidence = 70% of patients after Roux-Y gastric bypass

Deficiency Symptoms

- After hypoabsorptive methods (e.g. gastric bypass): Iron, calcium, folic acid, vitamin B_{12}, possibly other nutrients
- After BPD: proteins, fat-soluble vitamins (A, D, E and K)
- Therefore, the need for regular laboratory control + substitution

Other Gastrointestinal Complications

- Dehydration
- Intestinal obstruction, ileus
- Anastomosis leaks and fistulas
- Strictures/stenoses
- Incisional hernias or internal hernias
- Cholecystolithiasis and choledocholithiasis

7.5.3 Other Complications

- Venous thromboembolism
- Wound infections
- Bleeding
- Splenectomy after injury (rare)
- Incisional hernias or internal hernias
- Early postoperative ileus
- Gallstones

Complications in the SOS Study (Sjöström 2013)

- Postoperative complications = 13% of patients, of which
  - Bleeding = 0.5
  - Embolism/thrombosis = 0.8%
  - Wound complications = 1.8
  - Pulmonary complications = 6.1

7.6 Historical Interventions and Interventions in the Context of Studies

7.6.1 Historical Interventions

Jaw Wiring

- Historical intervention, no current application

Adjustable Gastric Banding (Vertical Banded Gastroplasty)

- Restrictive method
- Basic principle of the operation: Vertical partitioning of the stomach with attachment of a gastric band ("mesh") to control the diameter of the gastric outlet.
- Complications:
  - No long-term weight control
  - Intolerance of gastric constriction: vomiting, gastroesophageal reflux
  - Inflammatory reaction to the Band/Tube/Mesh: gastric stenosis
  - Free perforation due to erosion of the band

Jejunoileal Bypass (Intestinal Bypass)

- Hypoabsorptive method
- Procedure basis: Purely intestinal bypass; transection of the proximal jejunum, which is anastomosed distally to the ileum = bypass of up to 90% of the small intestine
- Complications:
  - perioperative complications, hypoproteinemia
  - Electrolyte dysregulation (loss via stool)
  - hepatic insufficiency, nephrolithiasis, autoimmune complications
  - bacterial overgrowth (SIBO)
  - Due to high complication rate = abandoned technique

Stomach Partitioning

- Restrictive method
- Basic principle of the operation: exclusion of a part of the stomach by double-row stapling to reduce the passage (no transection)
- Failure of this technique due to reopening of the stapler row or dilatation of the oral part of the stomach

7.6.2 Interventions in the Context of Studies

Laparoscopic Gastric Plication "Gastric Plication"

- Restrictive method
- Basic principle of the operation: reduction of the size of the stomach by inversion of the large curvature of the stomach internally
- Pros:
- Preservation of full stomach structure and function
- Comparable restriction as with sleeve gastric resection (see below)
- Disadvantages:
  - No long-term results currently known
  - Risk of gastric adaptation (due to distension) with renewed weight gain
- Complications:
  - Gastric perforation (<1%)
  - Excessive gastric constriction (<1%)
  - Slippage
  - Portal or mesenteric thrombosis

Endoscopic Sleeve Gastroplasty "Gastric Plication"

- Restrictive method
- same as laparoscopic gastric plication, but using endoscopy
- lesser results and complications

Mini Gastric Bypass

- Combined method
- Basic principle of surgery: narrow long gastric pouch (close to the gastroesophageal junction); anastomosis of the small intestine (150–200 cm distal from the Treitz ligament; without transection of the small intestine) with the pouch
- Pros:
  - Good weight loss (due to more hypoabsorption)
  - Effective procedure for the therapy of diabetes mellitus type 2
  - Shorter surgery time and anesthesia
- Disadvantages:
  - Dumping Syndrome
  - Hypoglycemia
  - Intestinal obstruction and internal hernia, "afferent-loop syndrome"…
  - Lifelong nutrient substitution (vitamins and minerals)
  - Increased rate of biliary reflux (bile gastritis, bile esophagitis)
  - marginal + gastric ulcers
- Complications:
  - Postoperative ileus (2–4%) due to intestinal obstruction
  - Anastomotic insufficiency (<1%)
  - Bleeding (<1%)
  - Need for conversion to Roux-Y-gastric bypass (5–10% of cases).

Ileal Transposition with/Without Sleeve Gastrectomy

- New method
- Procedural Basis:
  - Transposition of a 100 cm distal segment of the ileum (completely innervated and perfused) to the proximal jejunum
  - Objective = early stimulation of the ileum by nutritional components

Laparoscopic "Jejunal Sleeve" (On Gastric Bypass/Sleeve)

- Combined method
- As a revision procedure after gastric bypass for weight gain or as a primary procedure (in the context of studies)
- Procedural Basis:
  - 40 Fr bougie for stomach/jejunum calibration
  - Lateral resection of the gastric pouch (gastric sleeve)
  - Resection of the blind end of the jejunum

  - Sleeve resection of the jejunum over 15–25 cm
- Pros:
  - Simple rescue method after gastric bypass
  - BMI reduction of 5–10 extra points
- Disadvantages:
  - Currently still within the scope of studies
  - Medium- and long-term results missing
- Complications:
  - Stapler line/anastomosis insufficiency
  - Stenoses

Laparoscopic Single Anastomosis Duodenal Switch (SADI-S)

- Combined method
- Basic principle of the operation: formation of a tubular stomach; transection of the duodenum approx. 3 cm distal from the pylorus; duodenoileostomy approx. 2.5 m from the IC(ileocecal) valve (without transection of the ileum) leads to the absorption of proteins and fats only in the last 2.5 m of the ileum
- Pros:
  - Only one anastomosis (compared to the conventional duodenal switch), lesser operative time
  - Good results in terms of weight loss
  - Effective for reducing cholesterol and triglycerides
  - Effective in the treatment of diabetes mellitus type 2
  - Lesser risk of internal hernias
- Disadvantages:
  - Less weight loss than classic duodenal switch (not studied in detail)
  - No long-term results currently known
  - Possible bile gastritis
- Complications:
  - Intestinal obstruction (2–4%)
  - Anastomotic insufficiency (<1%)
  - Bleeding (<1%)
  - Need for reversion due to excessive hypoabsorption (2–5%) or insufficient weight loss

Myoelectric Gastric Stimulation

- Neurophysiological method
- Principle of action: Influencing the parasympathetic stimulation of the stomach and the intrinsic myoelectric activity of the stomach by means of a pacemaker
- Basic principle of the operation: Stomach stimulation by means of a pacemaker and electrodes in the gastric curvature
- Within the framework of studies

7.7 Metabolic Surgery

- Rapidly increasing importance of metabolic surgery

7.7.1 Definition

- Metabolic surgery (◘ Fig. 7.4 and ◘ Table 7.1) = not clearly defined
- In most cases, concept to denote currently experimental procedures
- Proper definition: shift of the primary focus of surgery to treat weight toward surgery to control metabolic disease (especially diabetes mellitus in those patients **without** severe obesity)

7.7.2 Scientific Basis

- Bariatric surgery = reduction in relative risk (%) for comorbidities in obese patients:
  - Cancer risk (76%)
  - Cardiovascular risk (82%)
  - Endocrinological disease risk (65%; after 10 years: 82.9% treatment of diabetes after bariatric surgery)
  - Infectious disease risk (77%)
  - Musculoskeletal disease risk (59%)
  - Respiratory disease risk (76%)
  - Psychiatric disease risk (47%)
- Bariatric surgery = reduction in direct treatment costs (over 5 years: $8813 in operated patients vs. $11,854 in non-operated patients; SEER registry, USA)

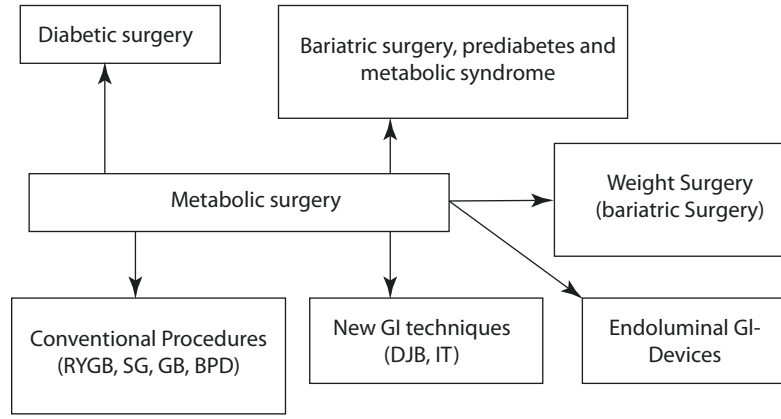

Fig. 7.4 Definition of metabolic surgery based on the goal of surgical therapy. *RYGB* Roux-Y gastric bypass, *SG* sleeve gastrectomy, *GB* gastric banding, *BPD* biliopancreatic diversion, *DJB* duodenojejunal bypass, *IT* ileal transposition. (Mod. according to Rubino et al. 2014)

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Table 7.1 Bariatric vs. metabolic surgery. (Rubino et al. 2014)

Comparison parameters	Bariatric surgery	Metabolic surgery
Diseases	Severe obesity	"Metabolic" obesity, diabetes mellitus type 2, metabolic syndrome
Primary objective	Weight reduction	Blood glucose and metabolic control, reduction of cardiometabolic risk
Criteria for the surgical indication	Weight-oriented (BMI)	Abdominal circumference, BMI, disease-specific parameters (Hb_{A1c}, C-peptide, insulin and glucose levels), response to alternative therapies, associated conditions that increase CVD risk and can be ameliorated by surgery (hypertension, dyslipidemia, sleep apnea syndrome, etc.)
Procedures	RYGB, sleeve gastrectomy, gastric banding, BPD, BPD/DS	RYGB, sleeve gastrectomy, gastric banding, BPD, BPD/DS, procedures within trials (duodenojejunal bypass, ileal interposition), device-based interventions[a]
Measurement of the treatment success	Overweight reduction >50	Glycemic control, dyslipidemia control, weight loss, CVD risk reduction
Composition of the treatment team	Surgeon, nutritionist, psychologist	Surgeon, endocrinologist, cardiologist, obesity specialist, diabetes consultant, etc.
Possible mechanisms of action	Simple, primarily mechanical[b]	Complex, neuroendocrine and/or metabolic[c]

BMI body mass index, *CVD* cardiovascular disease, *RYGB* Roux-Y gastric bypass, *BPD/DS* biliopancreatic diversion with duodenal switch

[a] Endoluminal liners, electrophysiological devices, etc.

[b] Restriction and/or malabsorption of energy intake

[c] Changes in gastrointestinal hormones, changes in appetite and hunger regulation, changes in nutrient perception, microbiotics, bile acid, etc.

7.8 S3 Guidelines (February 2018)

7.8.1 Quality Assurance

- Bariatric/Metabolic Interventions only in clinics with certification or aiming for certification
- The following procedures only in centers: age < 18 or age > 65, BMI ≥ 60, non-standard procedures (center with special expertise)
- Necessity of suitable equipment; imaging diagnosis + endoscopy available 24 h a day
- Entry of patients in national register; presentation of SOPs (Standard Operating Procedures)

7.8.2 Diagnosis and Evaluation

- Necessity of interdisciplinary opinion before a surgical measure for weight reduction
  - Presentation to a physician experienced in conservative obesity therapy is obligatory (e.g. nutritionist)
  - Further presentations in other disciplines depending on the comorbidities of obese patients (clinical psychology, psychosomatics, psychiatry, endocrinology, nutritional counseling)
- Comprehensive preparation of major abdominal procedures (medical history, documentation of concomitant diseases, current medication, complaints, symptoms, ECG, chest X-ray, routine laboratory, sonography of the abdomen, pulmonary function examination), exercise and behavioural therapy
- Need for an esophagogastroduodenoscopy (EGD) before any bariatric surgery
- Absolute exclusion of secondary causes of obesity (e.g. hypothyroidism)

7.8.3 Indication

- Primary indications for bariatric surgery:
  - BMI > 50 kg/m^2 + conservative weight loss attempt futile (classification of a multidisciplinary team) or in case of severe concomitant secondary disease without possible postponement
  - BMI ≥ 40 kg/m^2 without surgical contraindication after exhaustion of conservative therapy and after comprehensive clarification
  - 35 ≤ BMI < 40 + one or more obesity-associated sequelae/companion diseases (e.g. diabetes mellitus type 2, coronary heart disease) and after exhaustion of conservative therapy
  - Diabetes mellitus type 2 + 30 ≤ BMI < 35, if target levels cannot be met
  - Diabetes mellitus type 2 + BMI < 30, surgery can be offered as part of a study
  - In obese adolescents with significant comorbidities after failure of multimodal conservative therapy
- Age alone (> 65 years) = no contraindication; indication must be particularly justified (aim of the operation = prevention of immobility and need for care)
- Desire to have children = no contraindication to bariatric surgery
- After treatment of contraindication: Reevaluation

7.8.4 Choice of Procedure

- Currently no flat rate procedure for all patients
- Currently effective surgical procedures as first-line therapy:
  - Sleeve Gastrectomy (SM)
  - Roux Y Gastric Bypass (RYGB)
  - Omega Loop Bypass
  - Biliopancreatic diversion with duodenal switch (BPD/DS)
- Further procedures:
  - Biliopancreatic Diversion (BPD)
  - One-anastomosis bypass ("mini-bypass")
  - Vertical Banded Gastroplasty (VBP)
- Choice of procedure depends on:
  - BMI

- Age
- Gender
- Comorbidity
- Adherence
- Occupation

- Need for detailed consultation with the patient about:
  - Common procedures
  - Staged concepts (gastric balloon or sleeve gastric resection as first step)
  - Possible treatment alternatives
  - Possible complications (morbidity, mortality)
  - Aftercare (possible lifelong supplementation, plastic follow-up surgery)
- Need to consider patient preference in the absence of contraindication
- Indication + surgery by surgeons with expertise in hospitals with institutional experience

7.8.5 Technical Aspects and Complications

- Gastric balloon:
  - Necessity of the methylene blue sample for early diagnosis of balloon dysfunction
  - Previous gastric operations = contraindication with increased risk of perforation
- Gastric band:
  - Unconditional positioning of the band through pars flaccida of the omentum minus (minimization of the ligament dislocation rate)
  - Always laparoscopic
  - Lowest mortality, but results inferior to other techniques
- Roux-Y gastric bypass:
  - Laparoscopic surgery indicated
  - Target = small stomach pouch
  - Results: approx.—13–14 BMI points up to 5 years postoperatively
  - Length of alimentary limb = approximately 150–200 cm (for adequate weight loss + minor metabolic complications); biliopancreatic limb = 50–80 cm.
  - Position of the alimentary limb = antecolic-antegastric
  - for symptomatic reflux RYGB preferred
- BPD/DS:
  - Laparoscopic surgery indicated
  - Poutch: 200–500 mL
  - Length of the common leg = approx. 100 cm
  - DS with BMI > 50
  - Monitoring/prevention of deficiency symptoms necessary
- Sleeve Gastrectomy:
  - Laparoscopic surgery indicated
  - Calibration for gastric tube formation obligatory
  - For BMI > 60: Sleeve = procedure of choice (first stage of a multistage strategy)
- Simultaneous cholecystectomy
  - Indication in patients with preoperative symptomatic cholelithiasis
  - In asymptomatic cholelithiasis: consider prophylactic cholecystectomy
- Incisional hernia: postponement of surgical treatment until stable weight is reached
- Postbariatric plastic surgery

7.8.6 Aftercare

- Regular aftercare obligatory after bariatric surgery (experienced doctor + nutritionist); if necessary with outpatient cooperation partner
- Need for close monitoring in the first year postoperatively; within the first 3–6 months postop. by an bariatric surgeon
- Laboratory tests recommended for the detection of deficiency symptoms
- Supplementation with vitamins and minerals: obligatory for combination procedures and hypoabsorptive methods, recommended for purely restrictive methods with significant weight loss
- Psychological/psychosomatic/psychiatric care recommended in case of postoperative occurrence of psychological disorders
- Possible recommendation of participation in self-help groups
- In patients of childbearing age: during rapid weight loss Recommendation for contraception
- Consider possible dosage adjustment of medications

7.8.7 Guidelines

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