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## Perioperative care for bariatric surgery

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Once considered a high income country problem, overweight and obesity are now on the rise globally with tripling of obesity rates since 1975 in low and middle income countries. Obesity is a consequence of numerous factors from genes, diet, levels of physical activity, and the surrounding environment, as well as social and cultural factors. Obesity increases the risk of, and is associated with, several comorbidities including cardiovascular disease, hypertension, diabetes, musculoskeletal disorders, cancers, depression and anxiety. Severely obese individuals are three times more likely to require social care than those with a normal weight, resulting in increased risk of hospitalisation and associated health and social care costs<sup>9</sup>.

Body mass index (BMI), (weight in kilograms divided by the square of height in metres ( $\text{kg/m}^2$ ), is commonly used to classify overweight and obesity in adults.

### Classification of Obesity according to BMI<sup>3</sup>

BMI	Classification
Less than 18.5	Underweight
18.5 to 24.99	Normal range
25 to 29.99	Overweight
More than 30	Obesity
30 to 34.99	Obese class 1
35 to 39.99	Obese class 2
More than 40	Obese class 3

Bariatric surgery is the most effective and safe treatment for morbid obesity<sup>1</sup>, particularly when conservative measures of weight management have failed. According to the UK National Bariatric Surgery Register reports<sup>4</sup> over 21,000 procedures have been performed since 2012 with an estimated in-hospital mortality of less than 0.07% and with an average



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length of hospital stay for all operations of 2.6 days with significant regression of obesity associated conditions including diabetes, obstructive sleep apnoea (OSA) and hypertension and improvement in quality of life.

The perioperative care of a bariatric surgery patient in the UK is provided by a tertiary multidisciplinary team or a 4 tier team including surgeons, anaesthetists, specialist nurses, dieticians, psychologists, nutritionists and physiotherapists. Over 90% of bariatric surgery is carried out via the laparoscopic approach.

There are two main types of operations:

Restrictive: the inflatable gastric band, placed around a small pouch of stomach to reduce the size of stomach.

Malabsorptive:

1. The Roux-en-Y Gastric Bypass (RYGB), considered the 'gold standard' of weight loss surgery.
2. The Laparoscopic Sleeve Gastrectomy – often called the sleeve – is performed by removing approximately 80 percent of the stomach.
3. The Biliopancreatic Diversion with Duodenal Switch – abbreviated as BPD/DS – is a procedure with two components-a smaller, tubular stomach pouch with a large portion of the small intestine bypassed.



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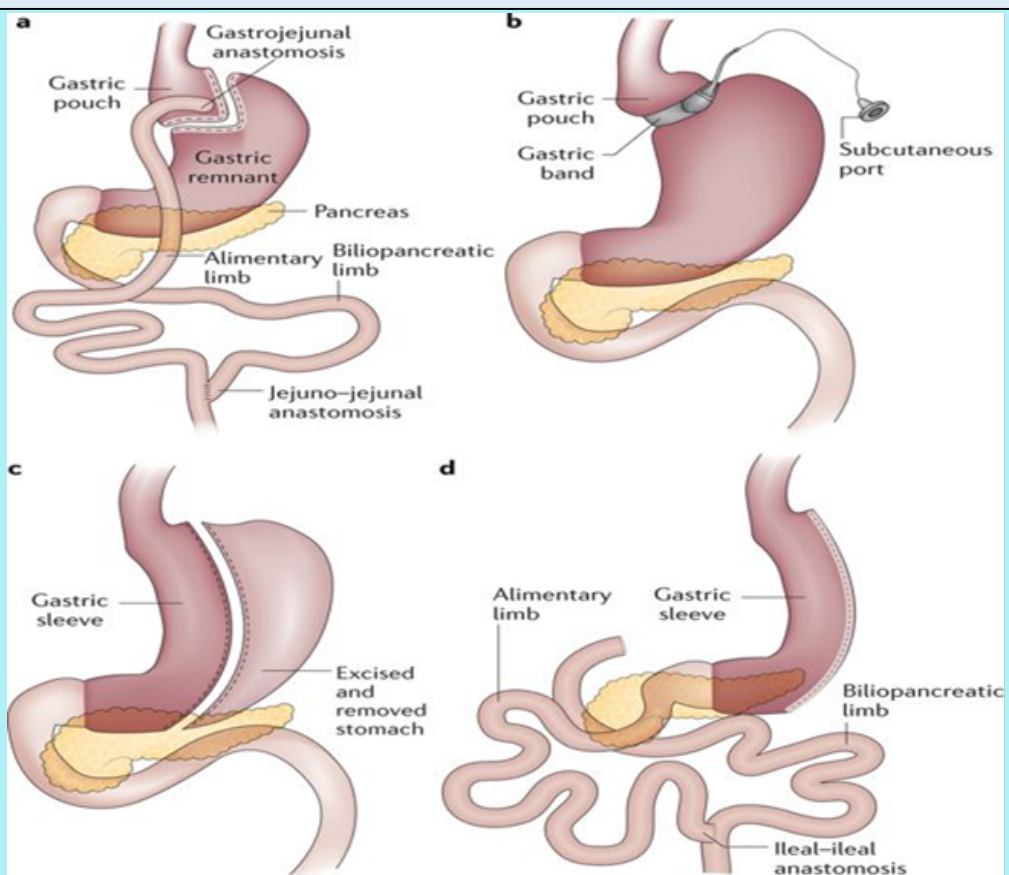
### Types of Bariatric Surgery<sup>18</sup>

**a= Roux-en-Y gastric bypass**

**b= Gastric band**

**c= Sleeve gastrectomy**

**d= Biliopancreatic diversion**





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**Preoperative assessment, optimisation and prehabilitation:**

As obesity is associated with several serious comorbidities, in addition to a thorough history and examination, preoperative assessment should look to identify heart failure, obstructive sleep apnoea (OSA), pulmonary hypertension and ischaemic heart disease and aim to optimise such conditions.

A focussed airway assessment should be performed and prophylaxis against aspiration should be routinely considered with proton pump inhibitors or ranitidine.

Investigations should include but not limited to baseline ECG, full blood count, kidney and liver function tests.

Patients should also be screened for micronutrient deficiency and long-term metabolic problems, particularly vitamin D and iron deficiencies.

We use the STOPBANG<sup>8, 10, 19, 20</sup> questionnaire (see below) to screen for OSA and sleep studies if indicated. Preoperative use of home continuous positive airway pressure (CPAP) ventilation is shown to improve right heart dysfunction, the patient's quality of life and reduce postoperative complications<sup>11</sup>.



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A dietician, psychologist and physiotherapy review with dual purpose of assessment and patient education regarding long-term diet and lifestyle changes following bariatric surgery is an essential part of preparation.

At our centre, as part of prehabilitation, patients are actively encouraged, supported and eventually required to stop smoking.

### **The STOP- BANG score<sup>8,10,19</sup>**

**S** Do you **S**nore loudly (louder than talking or loud enough to be heard through closed doors)?

**T** Do you often feel **T**ired, fatigued, or sleepy during the day?

**O** Has anyone **O**bserved you stop breathing during sleep?

**P** Do you have, or are being treated for, high blood **P**ressure?

**B** Does the patient have a **B**MI of more than 35?

**A** **A**ge, is the patient older than 50?

**N** Is the patient's **N**eck circumference greater than 40cm?

**Gender.** Is the patient male?

One point for each YES.

Score of  $\geq 3$  implies risk of OSA- consider further assessment

Score of 6 or more implies likelihood of OSA- sleep studies indicated

They are offered group education sessions with specialist bariatric dieticians, and physiotherapists with input from our specialist bariatric consultant physician and nutritionist.

The MDT aims to provide holistic patient-centred care and educate patients about managing their obesity as a life-long chronic condition with special focus on healthy eating, portion control, reduction of alcohol and fizzy-drink consumption and increasing physical activity.



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Specialist nurses and psychologists assess patients and form an important part of the long-term follow-up plan.

### **The liver shrinkage diet**

Obesity is commonly associated with an enlarged and fatty liver, restricting and complicating the surgical access to the gastroesophageal junction behind the left lobe and increasing the risk for laceration of the liver. A low-calorie, low-carbohydrate diet encourages the body to use the glycogen stores in the liver and shrink it. It is an effective, low cost way of reducing the liver size in obese patients.<sup>15</sup>

As part of optimisation, patients are advised to follow a calorie-restricted 'liver shrinkage diet'<sup>14</sup> for 2-6 weeks immediately prior to surgery, with the aim of reducing the size of obesity-associated enlarged liver and lose 5-10% of body weight. At our institution, the liver shrinkage diet consists of a low-fat, 1000-kcal/day diet with detailed written instructions given to patients. We offer three options to achieve this in consultation with our bariatric physicians and dieticians, tailored to patients' preference.

- 'Slimfast' diet- consisting of commercially available, high protein, low-calorie, low-sugar drinks
- 'Milk only' diet consisting of 4 pints of milk
- 'Food diet' a high-protein, low-carbohydrate diet with regular food

Patients are instructed to completely avoid high carbohydrate, high fat food items such as sweets, crisps and chocolates, fizzy drinks and alcohol with at least 1.5litre of water, multi-vitamins and fibre supplementation.

### **Preoperative risk stratification**

In the UK from 2013 to 16:

- The average bariatric patient body mass index (BMI) was 49.1 kg/m<sup>2</sup> and the average weight was 136.4 kg
- The average number of obesity-related diseases for each patient, for example type 2 diabetes, hypertension, sleep apnoea, functional impairment and arthritis was 3.59

The Obesity Surgery Mortality Risk Score (OS-MRS), a validated tool<sup>6,7</sup>, can be used to stratify risk and plan care for the bariatric surgical population.

Class C patients are likely to require closer postoperative monitoring and postoperative intensive care/high dependency unit admission can be considered.



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### Obesity Surgery Mortality Risk Score<sup>6,7</sup>

Risk factor		Points
Hypertension		1
Age more than 45		1
Male		1
BMI > 50kg/m <sup>2</sup>		1
Risk factors for pulmonary embolism (Pulmonary hypertension, previous PE)		1
Risk group	Score	Estimated mortality
Low	0-1	0.3%
Moderate	2-3	1.7%
High	4-5	3.2%

### Intraoperative Care:

The key element of care is meticulous attention to patient positioning, 'ramped' for airway management, steep reverse Trendelenburg position required for optimal surgical access with measures to prevent slipping, an inflatable hover mattress for safe transfers and careful protection of pressure areas to prevent nerve and skin damage.

### Airway management

At our institution we always induce general anaesthesia on the operating room table. An inflatable hover mattress should be considered for ease and safety of transfers

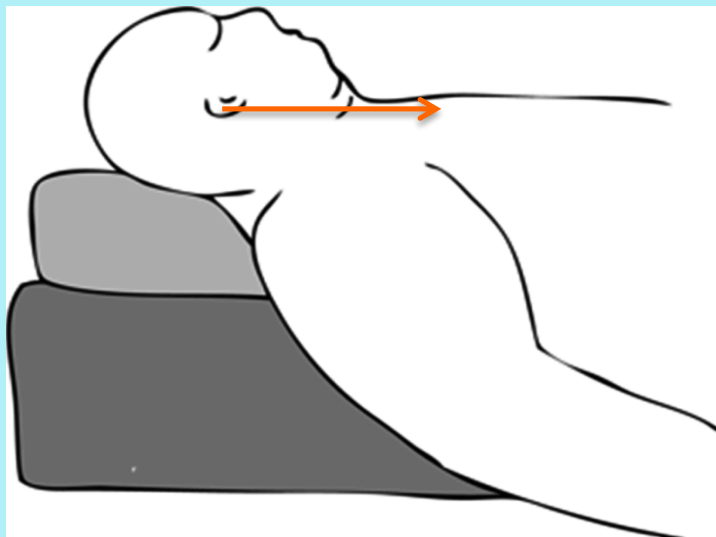
Obesity is associated with a 30% greater chance of difficult/failed intubation. We routinely 'ramp' our patients in 20-30 degree head up position i.e. elevate head and upper body until the external auditory meatus and the sternal notch are in the same horizontal plane to



facilitate ease of intubation (see picture below), and use video laryngoscopy as first choice for intubation. High flow nasal oxygen should be considered during intubation.

A large bore orogastric tube is inserted for some operations, which needs intraoperative manipulations and removal at the end.

**The 'ramped' position for airway management**



**Monitoring:**

We follow the standard AAGBI/SOBA guideline for intraoperative monitoring i.e. routine use of ECG, NIBP, SPO<sub>2</sub>, ETCO<sub>2</sub>, temperature and peripheral nerve stimulator for neuromuscular block.

Some points of note:

1. A range of large blood pressure cuffs should be available. The blood pressure cuff may need to be placed on the forearm when the upper arms are conical in shape.
2. The temperature probe should not be inserted in the oesophagus to avoid accidental stapling of the probe to the gastric sleeve.



3. Occasionally central venous access and invasive arterial monitoring may be needed.

**Perioperative drug dosing:**

Obesity can affect the distribution, binding, and elimination of the drugs with a tendency to accumulate lipophilic drugs, especially if given as infusions, however there is limited information on the effect of obesity on the pharmacology of commonly used anaesthetic drugs. Much of the excess weight is fat, which is usually poorly perfused. The volume of distribution of lipophilic drugs is likely to be more than those of hydrophilic ones.

Principles of perioperative anaesthesia drug use are:

- Caution with use of long-acting opioids and use of short-acting agents overall;
- Titrating drugs to effect;
- Drug dosing based on ideal body weight (IBW)/lean body weight (LBW) to avoid over-dosing.

LBW is the patient's weight excluding fat. Many of the formulae for calculating lean body weight are too complex for routine use. LBW rarely exceeds 100kg in men and 70kg in women.

We use the 'Ideal Body Weight' (IBW) and Adjusted body weight (ABW) as guides to drug dosing according to the AAGBI/SOBA guidelines.<sup>7</sup> Adjusted body weight takes into account the fact that obese individuals have increased lean body mass and an increased volume of distribution for drugs.

**IBW (kg) = Height (cm) MINUS x (where x = 105 in females and 100 in males)**

**ABW (kg) = IBW (kg) + 0.4 (Total Body Weight in kg MINUS IBW in kg)**

Some points of note in clinical practice:

- **Induction:**



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In the obese patient, after a bolus of anaesthetic induction agent, anaesthesia will occur before redistribution from the central compartment, and the induction dose required to produce unconsciousness correlates well with lean body weight. A more rapid redistribution of induction agents into the larger fat mass means that patients wake up more quickly than non-obese patients after a single bolus dose. A dose based on total bodyweight will last longer than one calculated using lean or adjusted body weight but is likely to result in significant hypotension.

- **Muscle relaxants:**

Hydrophilic drugs like neuromuscular blockers should be administered according to ideal body weight (IBW), as their volume of distribution (VD) remains relatively consistent. A dose of rocuronium based on total body weight does not significantly shorten the onset time but will increase the duration of action significantly.

Due to increased plasma cholinesterase activity, total body weight can be used for suxamethonium. Doses of neostigmine and sugammadex are related to the timing and total dose of neuromuscular blocking drugs to be reversed and should be titrated to effect.

- **Analgesia:** Opioids should be dosed using lean body weight as a starting point until the patient is awake and titrated to effect thereafter. Multimodal analgesia with paracetamol and non-steroidal anti-inflammatory drugs wherever possible should be used to minimize amount of opioids required.
- **Target controlled infusions:** The Marsh and Schneider formulae for target-controlled infusions (TCI) of propofol become unreliable for patients weighing over 140kg. None of the commercially available pumps allow input of weights above 150 kg using the Marsh model, or BMI > 35 kg/m<sup>2</sup> (female) and 42 kg/m<sup>2</sup> (male) using the Schneider model. If using propofol TCI, depth of anaesthesia monitoring should be used.
- Desflurane and remifentanyl lend themselves well to the obese population due to their unique pharmacokinetics.



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- The Society for Obesity and Bariatric Anaesthesia (SOBA) single sheet guideline is an excellent resource<sup>16</sup> and we have a laminated copy of the guideline attached to every anaesthetic machine.

**Dosing regimens for anaesthetic drugs<sup>7, 16</sup>**

According to Lean body weight Max 100kg in men, 70kg in women	According to Adjusted body weight
<b>Propofol (induction)</b>	Propofol (TCI)
<b>Thiopentone</b>	Alfentanil
<b>Rocuronium</b>	Antibiotics
<b>Vecuronium</b>	Low molecular weight heparins
<b>Atracurium</b>	Neostigmine (maximum 5mg)
<b>Fentanyl</b>	Sugammadex
<b>Morphine</b>	
<b>Paracetamol, NSAIDS</b>	
<b>Lignocaine</b>	

**Intraoperative ventilation strategies:**

Laparoscopy insufflation pressures used in bariatric surgery are commonly higher than usual 15-20mm of Hg.

We routinely use pressure-controlled ventilation with titrated PEEP to maximise tidal volumes for a given pressure and minimise intra- and postoperative atelectasis with monitored neuromuscular block. In practice, the steep reverse Trendelenburg position used for bariatric surgery mitigates the effect of pneumoperitoneum to a certain degree.

**Analgesia:**

Multimodal, opioid-sparing analgesia with titrated doses of long-acting opioids are the guiding principles.



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Regional analgesia can be useful but challenging, a rectus sheath block can be done by the surgeon under vision. Local anaesthetic infiltration should be routine.

We follow an enhanced recovery style protocol, with avoidance of PCA or urinary catheters to encourage early mobilisation.

**Extubation and transfer to PACU:**

Patients should be extubated awake in sitting position after reversal of neuromuscular blockade and return of airway reflexes.

An inflatable hover mattress is a very useful tool for transfers.

Monitoring should be continued in the recovery area.

All obese patients and particularly those with OSA, should be monitored for a period whilst unstimulated to rule out airway obstruction and respiratory depression.

**Postoperative care:**

As a high-volume centre with an experienced perioperative team, most of our patients are routinely looked after on surgical wards and very few patients are admitted to critical care. The important components of care are:

1. Early mobilisation and routine administration of prophylactic low molecular weight heparin, with compression stockings if required.
2. Early resumption of deep breathing exercises and CPAP if already in place for OSA.
3. Requirement for diabetes medications may decrease significantly in the first 48h.
4. Pain control: We use multimodal, opioid-sparing analgesia routinely and as required anti-emetics with avoidance of intramuscular medication. All oral medicines need to be prescribed in a crushed format for days to weeks after bariatric surgery, until patients can resume taking tablets.
5. Wound care and avoidance of infection
6. We usually discharge patients on day 1 or 2 post operatively, with arrangements for long-term follow-up care.

**The obese patient for non-bariatric surgery**



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As the rates of obesity continue to rise, an average UK district general hospital serving an adult population of 200 000 is likely to see 52 000 obese and over 6000 class-3 obese patients per year.<sup>7,14,15</sup>

The Association of Anaesthetists of UK guideline<sup>7</sup> describes in detail the recommendations for perioperative care of the obese population, including the logistics and personnel needed.

A significant amount of the perioperative care described above is applicable to any obese patient. In general, as anaesthetists, our expertise comes into play and is often challenged, by intravenous access, safe airway management (particularly outside of theatre environment), moving and handling and assessment and treatment of the unwell obese patient.

The Obesity Surgery Mortality Risk Score although only validated for bariatric surgical patients, can be applied to obese patients undergoing non-bariatric operations and guide perioperative management.

### **Special situations:**

#### **Day case surgery and obesity:**

Obese patients are likely to benefit from day case surgery, weight or BMI alone should not be used to exclude them from Day case. Certainly, obese patients with significant co-morbidities or BMI more than 40kg/m<sup>2</sup> warrant further assessment with an experienced anaesthetist to determine suitability.

#### **Obstetrics and obesity:**

Without going into detail, the outcomes for obese mothers and their babies are poorer than the general population<sup>17</sup>. Difficult intravenous access, difficult neuraxial block insertion, difficult airway, induction of labour, peripartum infection, operative delivery, post-partum hemorrhage and venous thromboembolism are more common in the obese population<sup>17</sup>.

In addition to bariatric surgery, our hospital in East London has a busy maternity unit with a significant high-risk, obese population. In addition to the anaesthetic preassessment clinic for



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maternity, we have a multidisciplinary team (including dieticians, anaesthetists, obstetricians, midwives, physiotherapists) running a group clinic every month for women with BMI higher than 40. A specialist area of clinical practice at our hospital where we frequently encounter morbidly obese pregnant women is day case surgical termination of pregnancy.

### Summary

Obesity is a complex and chronic condition, as bariatric surgery becomes more common, we as anaesthetists should be familiar with the perioperative care for bariatric surgery. Many of the skills as a 'bariatric' anaesthetist are transferable, which should become an essential component of the skillset belonging to a 'generalist' anaesthetist.

### MCQ'S/SBA

1. According to the WHO, the definition of 'overweight' is.
  - a. BMI more than 30
  - b. BMI more than 25
  - c. BMI 25 to 29.9
  - d. BMI 25 to 30
2. Obesity increases the risk of
  - a. Diabetes
  - b. Hypertension
  - c. Cancer
  - d. Cardiovascular disease
  - e. ALL of the above
3. Reported incidence of difficult intubation associated with obesity
  - a. Less than 10%
  - b. 30%
  - c. 20-30%



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d. 25%

4. What is the main cause of the world-wide obesity epidemic?
- a. Calorie-dense diet with sedentary life style
  - b. Decreased physical activity
  - c. Epigenetic changes
  - d. All of the above

#### Answers

- 1. a
- 2. e
- 3. b
- 4. d

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