BJA Education, 20(11): 388–395 (2020)

doi: 10.1016/j.bjae.2020.07.003
Advance Access Publication Date: 27 August 2020

Matrix codes: 1I05, 2A03, 3A13

Anaesthesia for the obese patient

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Keywords: anaesthesia; bariatric; obesity

Learning objectives

By reading this article you should be able to:

- Describe the limitations of BMI when classifying obesity.
- Understand the impact of obesity and related health conditions upon the provision of anaesthesia.
- Identify the high-risk obese patient.
- Plan safe and individualised perioperative care determined by comorbidities and the extent of surgery.

Key points

- Obesity only increases perioperative risk significantly when BMI is $\geq$40 kg m^{-2}, or when associated with significant comorbidities.
- Day-case surgery is usually appropriate if BMI is <50 kg m^{-2} and comorbidities are optimised.
- Obstructive sleep apnoea and obesity hypoventilation syndrome are common high-risk conditions that influence management of anaesthesia.
- Rapid sequence induction should not be routine in the absence of specific indications.
- Previous bariatric surgery has important implications for subsequent anaesthesia.

Obesity is a global epidemic and despite various actions there has been little success to reduce this. As a common disorder this places the anaesthetic management of obese individuals at the core of anaesthetic practice. This article offers an update in epidemiology, perioperative risk and the associated morbidity that obesity causes and its impact on anaesthetic management.

Epidemiology

The prevalence of obesity has tripled over the past 40 yrs and there are now more than 650 million obese adults worldwide. Increases are greater in developing compared to developed countries.

UK and continental Europe

The UK has the sixth highest prevalence of obesity according to the Organisation for Economic Cooperation and Development (OECD). Some 64% of UK adults are overweight or obese, with lower socioeconomic groups over-represented. Only five European countries have a prevalence of obesity amongst adults of <20%. In these countries, more than half of all adults are overweight.

Worldwide

The USA has the highest rates of obesity; 88.5% of the population are overweight and 36.2% are obese. Rates are similar in Canada, Australia and New Zealand. South Africa ranks 30th worldwide for the prevalence of obesity.

Categorisation of obesity

Obsolete classifications include 'morbid obesity', 'super obesity', 'super-morbidly obese' and 'super super morbidly obese'.

BMI

BMI is a commonly used measurement of obesity, its advantage being that it is easy to calculate. BMI does not describe the

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Accepted: 6 July 2020

composition and distribution of body tissue (muscle/adipose) or metabolic state. These are important factors in terms of pathophysiology, perioperative risk and management. BMI can be useful to alert teams and allow planning and preparation. Table 1 details the latest classification of obesity according to BMI, and the ASA grade corresponding to each class.

Morbidity and mortality risk

The health risk from obesity is not uniform across all ethnic groups, with black African-Caribbean, Asian ethnic groups and older people having an increased risk of developing health conditions associated with obesity.[1]

Obesity is often assumed to increase the risk of perioperative morbidity and mortality. The past decade has seen an increase in data contradicting this assumption about patients with Class 1 and 2 obesity undergoing most surgical procedures.

BMI and the 'obesity paradox'

Class 3 obesity is associated with increased postoperative morbidity and mortality. However, overweight, Class 1 and 2 obese patients often have a lower incidence of complications and mortality than patients of normal weight. This is found across a range of surgical procedures including hip fractures (up to 35% less chance of death within 1 yr).[2] Patients with low BMI (<18.5 kg m^{-2}) tend to have the highest mortality rates of the different BMI groups. This 'obesity paradox' whereby obesity may convey health benefits is not fully understood.

It is proposed that rather than direct health benefits from excess adipose tissue that the 'obesity paradox' is a consequence of unrecognised differences between BMI groups, for example cigarette smokers and patients with disease-induced weight loss, but the 'obesity paradox' is still seen in studies where smoking has been accounted for.[3]

Age

Increasing age is associated with reduced functional reserve and can be associated with an increased postoperative mortality and morbidity.

In obesity this association is not fully supported. Age ≥65 yrs was found to be an independent risk factor for postoperative complications in Class 3 obese patients undergoing posterior lumbar fusion.[4] The development of severe life-threatening complications after bariatric surgery was not linked to age in another study. Overall mortality was increased more than three-fold in those aged ≥55 yrs compared with those aged <55 yrs, suggesting that the older group were less able to recover from complications.[5]

Table 1 WHO classification of obesity and ASA grades

Category	BMI (kg m^{-2})	ASA grade
Underweight	<18.5	1
Normal weight	18.5–24.9	1
Overweight	≥25	1
Preobese	25–29.9	1
Obese	≥30	1
Class 1	≥30–34.9	1
Class 2	≥35–39.9	2
Class 3	≥40	3

Distribution of fat

The terms 'apples' and 'pears' are commonly used to describe predominantly central (abdominal/visceral) and peripheral adipose tissue, respectively. Central obesity is defined by WHO as a waist circumference >102 cm and >88 cm for men and women, respectively, and in the Asian population >90 cm and >80 cm.

Adipose tissue distribution can be accurately defined by CT and MRI. Simply measuring waist circumference or visual assessment of the fat distribution of patients will identify those with greater perioperative risk and associated comorbidities.

Fat distribution predicts risk more accurately than BMI; central obesity has associated greater risks of metabolic syndrome (MetS), cardiovascular disease, difficulty in airway and ventilation management and overall perioperative risk.[6]

Presence of comorbidities

Many of the comorbidities associated with obesity are known to increase perioperative risk. Sleep disordered breathing is associated with difficult airway management, unplanned tracheal reintubation and postoperative cardiopulmonary complications. Risks can be reduced by good preoperative optimisation and compliance. The degree to which comorbidities increase perioperative risk for obese patients is not clear, and studies investigating this may be affected by the 'obesity paradox'.

MetS

Metabolic syndrome comprises a cluster of conditions and is increasingly recognised as a major contributor to perioperative morbidity and mortality. Compared with the obese patient who does not have MetS there is an increased risk of developing cardiovascular disease and an even greater risk of developing Type 2 diabetes mellitus.[7] Numerous international diagnostic criteria exist, each requiring the presence of three of the factors listed in Table 2.

Obesity and MetS cause significant increases in postoperative mortality in all classes of obesity, with greater risks of postoperative cardiac complications (2–3× risk), pulmonary complications (1.5–2.5× risk), acute kidney injury, stroke and development of sepsis compared with patients of normal weight.

Functional capacity

There are limitations in assessing cardiorespiratory fitness in obese patients. Enquiry about functional capacity can inform risk; the ability to achieve more than four metabolic equivalents (METs) indicates a lower risk of major surgery. There are many reasons why obese patients may not exert themselves to this degree, which alone does not define an unfit patient.

Sarcopenic obesity

Sarcopenic obesity is characterised by reduced muscle mass and functionality in the presence of obesity, and there are trends towards adverse outcomes, particularly with age.8

Table 2 Health conditions associated with obesity, suggestive features and the perioperative actions required. ABG, arterial blood gas; BiPAP, bilevel positive airway pressure; CPET, cardiopulmonary exercise testing; DM, diabetes mellitus; ECHO, echocardiogram; HDL, high-density lipoproteins; HDU, high dependency unit; LFTs, liver function tests; METS, metabolic equivalents; NAFLD, non-alcoholic fatty liver disease; NASH, non-alcoholic steatohepatitis; OHS, obesity hypoventilation syndrome; OSA, obstructive sleep apnoea; SBP, systolic BP; SDB, sleep disordered breathing

Conditions	Suggestive features	Actions required before surgery
Respiratory		
Sleep-disordered breathing (OSA, OHS)	Shortness of breath Sp_{O_2}<95% breathing air STOP-BANG ≥5 OHS—BMI>30, hypercapnia when awake, raised HCO_3, hypoxia, exclusion other causes of hypoventilation	• ABG initially • Spirometry • CPET if abnormalities found in above tests • Airway planning—4× increased risk of difficult intubation and difficult mask ventilation • Refer for further investigation and treatment • Commence CPAP before surgery and continue after surgery • BiPAP sometimes necessary for improvement in symptoms (especially OHS) • Plan for postoperative HDU/ICU admission if symptoms not improved by time of surgery
Asthma	Dyspnoea Wheezing	• Asthmatic symptoms common but reversibility with β_2-agonists not always found—cause is partly chronic pro-inflammatory state from excess adipose tissue, and fat within/around chest/abdomen causing small airway collapse • Weight loss: symptoms from both 'classical' asthma and fat-related wheeze will improve
Cardiovascular		
Hypertension Left ventricular hypertrophy Left ventricular failure Conduction abnormalities Cardiomyopathy	Clinical signs of heart failure History of cardiac syncope. Increased SBP Reduced exercise capacity	• Preoperative ECG • ECHO if structural or functional disease suspected • Referral to cardiologist • Medical management and optimisation before surgery
Right heart failure	Pulmonary hypertension resulting from sleep-disordered breathing Polycythaemia	

Reduced functional capacity	Difficult to assess in obese patients
	Ability to achieve 4 METS indicates fitness and low risk patient
		• Assess ability to walk on a flat level surface
		• Assess climbing stairs
		• CPET:
		  • not routine, but can be used where assessment suggests high risk patient
		  • equipment may not tolerate patients' weights
		  • obesity can confuse interpretation of results

Metabolic		
Diabetes mellitus	Deranged serum glucose, HbA_{1C}, or associated complications	• Optimise glucose control with referral to endocrinologist • Avoid delaying surgery based on HbA_{1C} concentrations only
Liver involvement (NASH/NAFLD) Metabolic syndrome	Evidence of cirrhosis, deranged LFTs Central obesity, hypertension, impaired glucose handling or DM, increased triglycerides, decreased HDL cholesterol	• Liver-shrinking diet (<1000 calories per day) can reverse the disease processes somewhat • Actively seek components of metabolic syndrome (three or more required for diagnosis)

Varying diagnostic criteria result in the exact risk being unclear. The presence of sarcopenic obesity is suggested by:

(i) poor grip strength;
(ii) history of immobility;
(iii) slow gait.

Preoperative assessment and risk prediction

The principles of preoperative assessment in the obese patient are the same as for all patients. No special investigations are performed routinely. The most important factors to identify are:

(i) central or peripheral distribution of fat;
(ii) presence of MetS;
(iii) peripheral oxygen saturation <95% breathing air.

Health conditions identified after full assessment require optimisation before scheduling surgery. Table 2 describes the actions that should be considered. The use of multidisciplinary team meetings may facilitate optimisation.

Factors known to increase unanticipated admission to critical care include:

(i) diabetes mellitus;
(ii) chronic respiratory disease;
(iii) open abdominal surgery.[9]

Risk prediction can be facilitated with the obesity surgery-mortality risk score (Table 3). The score can be used to plan the need for postoperative care; a score of 4–5 indicates a high-risk patient and should prompt consideration of post-operative admission to critical care.[10] Though only validated for use in bariatric surgery, it can also be applied to non-bariatric patients.

Organisation and equipment

Preoperative assessment should assess the ability of a patient to mobilise on the day of surgery and after surgery to enable planning of equipment, personnel and identification of any potential hazards or unsuitability.

Preparation and dignity

Obese patients are mindful of societal views about their size; concerns about their self-image figure highly. Dignity is important in the obese individual. Ensure theatre gowns of an appropriate size are available, appropriately-sized underwear, and rooms are accessible with toilets and showers that can accommodate the patient's size and weight. The risk of deep vein thrombosis is increased in the obese, with up to 10 times greater incidence after surgery.[11] Deep vein thrombosis risk should be assessed and prophylaxis measures following national guidance used for all obese patients.

Moving and positioning

Appropriate equipment availability to transfer the patient is required. This may include transport from home into the hospital, in which case appropriate vehicles are necessary. Chairs, trolleys, beds and operating tables must be safe for use up to or above the patient's weight, and through the full anticipated range of positions and movements required (e.g. operating tables may be safe to use for a given weight in the neutral position, but not able to be positioned head down or head up at maximum weight). It should be confirmed before surgery that the patient's accommodation is acceptable: it is mandatory to maintain their dignity and safety. Adjuncts can be utilised to accommodate patients where it is confirmed the equipment can hold the weight, such as extra-wide extensions for operating tables and arm gutters.

Table 3 OS-MRS for risk prediction. OS-MRS, obesity-surgery mortality risk score; OHS, obesity hypoventilation syndrome; OSA, obstructive sleep apnoea; PE, pulmonary embolism; VTE, venous thromboembolism

OS-MRS	
Risk factors	**Points scored**
BMI>50 kg m^{-2}	1
Male	1
Hypertension	1
Age >45 yr	1
Risk factors for PE (previous VTE, preoperative vena cava filter, OSA/OHS, right heart failure, pulmonary hypertension)	Maximum 1

Wherever possible the patient should maintain their own mobility (e.g. to walk to theatre and position themselves on the operating table). Gel pads should be used to protect pressure points. Attention to these areas during anaesthesia is vital; numerous reports define crush injury from patient positioning (classically from gluteal ischaemia with prolonged pressure at the time of surgery) and rhabdomyolysis. At the end of surgery, transfer from the operating table to ward bed can be facilitated with slide sheets or hover mattresses. The patient can remain on these devices to aid postoperative care.

Monitoring and ventilation

Invasive arterial monitoring is not routine for obese patients. Non-invasive BP cuffs should be of the correct size. The shape of the arm may make accurate measurement impossible on the upper arm, in which case the forearm can be used. Anaesthetic ventilators should be capable of delivering high driving pressures and able to deliver PEEP. The potential for incomplete neuromuscular block antagonism demands routine neuromuscular monitoring.

Ultrasound

Ultrasound visualisation may be useful to facilitate successful regional blocks and in cases of difficult venous access.

Postoperative

Walking aids and structures that can be attached to hospital beds to improve patient independence and rehabilitation should be available.

Induction of anaesthesia

Induction of anaesthesia should be undertaken in the operating theatre. This mitigates unnecessary risk created by transferring an anaesthetised obese patient into the operating room, and makes the management of any adverse events more practical with sufficient assistance available.

Patient position

Anaesthesia should be induced in the head up ramped position with elevation of the upper body until the ear tragus and sternal notch are aligned horizontally. This can be achieved by folding sheets and blankets under the head and neck or using specialised pillows. This position offers advantages:

(i) increased comfort for the patient;
(ii) functional residual capacity is maintained;
(iii) reduced dyspnoea;
(iv) bag-mask ventilation is facilitated;
(v) laryngoscopy is improved.

Airway

Standard airway devices and adjuncts should be available including supraglottic airway devices (SAD), video laryngoscopes and, when indicated, fibreoptic endoscopes. There are no special or preferred choices of equipment for airway management in obese patients.

Tracheal intubation is the recommended technique for airway management. Whatever aid to intubation is used, it should be one with which the anaesthetist is most familiar with and which offers the best chance of success. For experienced practitioners, after full assessment and consideration of the proposed surgical procedure, the use of an SAD may be appropriate. This should be with a second-generation device, and caution is strongly advised when BMI is >40.

Obesity is associated with a higher risk of developing airway problems under anaesthesia. The UK NAP4 study revealed twice the rate of adverse events, particularly with the use of SAD, and a greater failure rate of rescue techniques.[13] Routine airway assessment defining indicators of potential difficult laryngoscopy or difficult ventilation should always be performed, particularly identifying:

(i) Mallampati score ≥3 (predicts difficult facemask ventilation and intubation)[14];
(ii) neck circumference >42 cm (predicts difficult intubation)[15];
(iii) BMI >50 kg m^{-2} (independent predictor of both difficult intubation and facemask ventilation)[16];
(iv) the presence of a beard;
(v) symptoms of gastro-oesophageal reflux disease.

The varying definitions of a 'difficult airway' lead to difficulty in identifying good predictive features. Neck circumference appears to be one of the best predictors in the morbidly obese.[17]

Obese patients have increased oxygen consumption and CO_2 production because of increased total body tissue mass and increased work of breathing. This can lead to hypercapnia and hypoxaemia when ventilation is impaired. Excess adipose tissue reduces chest wall compliance, which reduces functional residual capacity (FRC) to closing capacity, leading to atelectasis. Further reductions in FRC during general anaesthesia, when lying supine and during pneumoperitoneum, will exacerbate this.

The onset of hypoxaemia can be delayed by preoxygenation of the lungs, induction of anaesthesia in the semi-upright position with application of CPAP or high-flow nasal oxygen, and avoidance of prolonged apnoea. Currently there is no evidence to demonstrate one technique is superior to another.

Routine awake fibreoptic airway management is not indicated unless a specific reason is identified at preassessment.

A backup plan for airway management should be agreed should the primary plan fail. This must be communicated to the whole theatre team, and should follow the Difficult Airway Society guidelines.

Front of neck airway access may be more difficult with a risk of complications. This should be considered when planning airway management; in high-risk cases it may be appropriate to identify the depth of the cricothyroid membrane, vascular tissue, and mark relevant landmarks to improve the chance of success of emergency front of neck access.

Routine RSI

Obesity is associated with an increased incidence of known risk factors for aspiration, such as hiatus hernia and diabetes mellitus with autonomic neuropathy causing delayed gastric emptying. However, evidence reveals that obesity alone does not increase the risk of reflux and pulmonary aspiration. In the absence of any risk factors for aspiration (e.g. a patient who is unfasted, or who has intra-abdominal pathology) performing an RSI is not routinely required.

Failed intubation after induction of anaesthesia requires antagonism of neuromuscular block. When sugammadex is available there is much greater control of the antagonism of rocuronium-rather than suxamethonium-induced neuromuscular block, with longer or shorter block duration as required. A recent article in this journal offers analysis of the factors that influence how an RSI is conducted.[18]

Awareness

The NAP5 study revealed an increased incidence of awareness in obese patients shortly after induction of anaesthesia.[19] This is attributable to the rapid redistribution of i.v. anaesthetic agents. In order to reduce occurrence, anaesthetists should ensure adequate dosing of i.v. anaesthetic agent, prompt delivery of maintenance anaesthetic agent and further i.v. bolus(es) of anaesthetic agent before airway manipulation or protracted airway manoeuvres.

Principles of drug dosing

The principles of dosing anaesthetic drugs for obese patients have recently been described in this journal.[20] Lean body weight reflects excess non-adipose tissue of obese patients. This can be considerably greater than ideal body weight, generally peaking at 100 kg and 70 kg for male and female patients, respectively. Lean body weight is usually the appropriate scalar to calculate drug doses, with a few exceptions. Emergency medications such as noradrenaline (norepinephrine) and adrenaline (epinephrine) are dosed according to ideal body weight, suxamethonium according to total body weight and the minimum dose of atropine according to lean body weight, as lower doses can cause paradoxical bradycardia.[20]

Maintenance of anaesthesia

TIVA with propofol offers a number of potential advantages over volatile anaesthesia for the obese patient: rapid offset of action; 'clear-headed' emergence; reduced incidence of laryngospasm; reliable clearance of hypnotic agents; reduced postoperative nausea and vomiting; and maintained anaesthesia during protracted airway manipulation.[21]

Currently pharmacokinetic models for propofol are not validated in obese patients who were excluded from initial development of these models. To minimise the risk of accidental awareness, the use of processed EEG-based depth of anaesthesia monitoring, continuous clinical observation and interpretation of vital signs should guide titration of drug infusion targets and rates.

Using volatile agents with a rapid offset of action (low blood:gas partition coefficient) such as desflurane and sevoflurane may limit absorption into adipose tissue, reducing the risk of resedation, deteriorating respiratory function and airway obstruction at emergence.

Ventilation

Obesity is an independent risk factor for developing postoperative pulmonary complications. Current recommendations for ventilation include lung protective volumes (6–8 ml kg^{-1}), plateau pressures <30 cmH_2O and titration of PEEP guided by the patient's respiratory and cardiovascular state.

Table 4 Factors specific to obese patients that affect the appropriateness of day-case surgery. CCF, congestive cardiac failure; HTN, hypertension; IHD, ischaemic heart disease; NIV, noninvasive ventilation; OHS, obesity hypoventilation syndrome; OSA, obstructive sleep apnoea; OS-MRS, obesity-surgery mortality risk score; VTE, venous thromboembolism

	Patient-specific factors	Anaesthetic factors	Surgical factors
Appropriate for day case surgery	• Any BMI • Good functional capacity • OSA/OHS effectively treated by CPAP/NIV • Able to continue VTE prophylaxis at home if required	Adequate time on list to anaesthetise Regional anaesthesia possible Experienced anaesthetic, operating theatre and day-case ward team	Adequate time on operating list to perform surgery, taking into account expected time to discharge Appropriate equipment for surgery and postoperative care available
Inappropriate for day case surgery	• Poor functional capacity • Unstable HTN, IHD, CCF • Unstable respiratory disease (low Sp_{O_2}, OSA/OHS untreated or no symptomatic improvement after treatment) • Previous VTE • Metabolic syndrome • OS-MRS 4–5	Likely to require long- acting potent opioids	

In the absence of high-quality studies identifying optimal levels of PEEP or use of alveolar recruitment manoeuvres, the authors advise application of high levels of PEEP (8–10 cmH_2O) titrated according to oxygenation and observed compliance, and the judicious use of alveolar recruitment manoeuvres where the clinical picture suggests significant lung collapse or atelectasis, as this addresses the physiological changes that are known to take place in anaesthetised obese patients.

The patient's position has a significant effect upon airway pressures. During laparoscopy for upper abdominal surgery the patient should be positioned in the 20° reverse Trendelenburg position with 45° hip flexion, and flat Trendelenburg position for lower abdominal surgery, to reduce airway pressures.[22]

Antagonism of neuromuscular blocking agents and sugammadex

Airway and respiratory problems during or after emergence can be significantly more hazardous in the obese than in the non-obese. It is important to take measures to minimise the risk of these problems occurring. In general, the patient's lungs should be ventilated with 100% oxygen until $P_{E'O_2}$ is ≥0.9, the patient is in the upright position; the trachea should only be extubated once the patient is able to obey commands and maintain spontaneous ventilation with adequate tidal volumes.

Ensuring full reversal of neuromuscular block before emergence should be standard. This can be achieved by the use of appropriate doses of either neostigmine, or with sugammadex if rocuronium or vecuronium (though not as

Table 5 Most common primary weight loss surgeries, and their implications for subsequent anaesthesia.[24] NGT, nasogastric tube

Procedure (% of all procedures)	Classification	Specific management principles
Sleeve gastrectomy (46%)	Restrictive	These patients should routinely be intubated as there is a significant risk of reflux of gastric contents, regardless of the presence of symptoms.
Roux-en-Y gastric bypass (38%) One anastomosis gastric bypass (8%)	Malabsorptive Malabsorptive	May affect bioavailability of oral medications as a result of shortening of the small bowel and loss of surface area (e.g. postoperative analgesia absorption).
Adjustable gastric banding (5%)	Restrictive	High risk of aspiration despite prolonged fasting times. RSI with antacid premedication should be routine. Avoid NGT unless acute abdomen or bowel obstruction (risk of displacing band, or perforation of proximal stomach). The band should not be deflated (risk infection to the system, band erosion into the stomach or damage to the band); if considered essential this should only take place after discussion with bariatric surgeon, using a non-coring needle and with full sterile precautions.

effectively antagonised as rocuronium) have been used. Sugammadex antagonism will be preferable for obese patients in many situations because of the difficulties around dosing of both neuromuscular blocking agents and neostigmine, and the time constraints associated with this combination, but attention should be given to the patients at risk of recurarisation. Supplementary Table 1 (Supplementary material) summarises the advantages and disadvantages of these drugs.

Postoperative care

Recovery should be in a 30–45° head up position, and there is evidence that CPAP started in the early postoperative period may enhance recovery of normal respiratory function.

Before discharge from recovery unit the patient should:

(i) have unsupported stable vital signs with minimal inspired oxygen requirement;
(ii) show no evidence of hypoventilation;
(iii) be free from apnoeas without stimulation;
(iv) be able to use a CPAP device if required.[6]

Opioids should be avoided and the patient mobilised early with regular reviews by an experienced consultant on the postoperative ward. The requirement for i.v opioids should prompt continuous Spo_2 monitoring and consideration of a higher level of care. Any patient with significant comorbidities should be considered for critical care admission.

Day-case surgery

Day-case or ambulatory surgery can be undertaken safely in obese patients after appropriate selection. Recovery, discharge and unanticipated admission rates are not increased.

There is an increased risk of complications for day surgery with BMI>50 so careful assessment and consideration for admission is required.[13]

Consideration of risk factors (Table 4) should guide decisions to proceed. The usual surgico-social contraindications for day-case surgery still apply.[6,12] Clear pathways for the perioperative management of obese patients, including admission criteria, should be adhered to and all patients need a review in the preanaesthetic clinic.

Anaesthetic techniques

Anaesthesia for day-case surgery should provide rapid cognitive recovery; good quality opioid-sparing analgesia enabling return to normal function and mobilisation.[23] This may include regional anaesthesia and neuraxial blocks.

Implications of previous bariatric surgery

Table 5 shows the most commonly performed primary procedures with their impact upon subsequent anaesthesia.

Conclusions

Managing obese patients will be an increasing part of most anaesthetists' practice over the coming years. Delivering resource efficient, high-quality, safe care requires planning and optimisation, particularly in the high-risk subgroups. Planning from first presentation in terms of equipment and personnel required and likely postoperative requirements is essential. Anaesthesia should be tailored to the physiological changes seen in obesity and the presence of comorbidities. Day-case surgery is a feasible and safe option.

Declaration of interests

A.W.H. is a trainee editor and editorial board member of *BJA Education*. D.C.B. declares that he has no conflicts of interest.

MCQs

The associated MCQs (to support CME/CPD activity) are accessible at www.bjaed.org/cme/home by subscribers to *BJA Education*.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bjae.2020.07.003.

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