1. INTRODUCTION

The prevalence of is obesity increasing year on year. There are now more than 650 million obese adults worldwide and 64% of adults in the UK are classed as overweight or obese[1] .

As these figures increase, anaesthetists will encounter patients with obesity and morbid obesity more frequently. Knowledge of how to recognise patients with associated co-morbidities, assess perioperative risks and manage intraoperative and post-operative care is key. The purpose of this document is to provide guidance to medical or nursing staff who are involved in the management of patients with morbid obesity undergoing anaesthesia for elective and emergency procedures.

Specific Staff Groups
Anaesthetists Operating Department Practitioners Theatre Nurses, HCAs, TSAs Recovery Nurses Theatre Managers
Specific Patient group
Patients with Morbid Obesity (BMI >40kg/m^2) undergoing elective and emergency anaesthesia and surgery (non-obstetric).

Categorisation of BMI – WHO classification of obesity and ASA grade

Category	BMI	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**

2. GUIDELINE STANDARDS AND PROCEDURES

ORGANISATIONAL MANAGEMENT

1. There should be an allocated clinical lead for Obesity.
2. Operating lists should include the patients' weight and body mass index (BMI).
3. When theatre list time is being allocated on ORMIS for patients with BMA >40, an additional 45 minutes should be added to the anaesthetic time.
4. Experienced anaesthetic and surgical staff should manage morbidly obese patients.
5. Additional specialised equipment is necessary.

SPECIALIST EQUIPEMENT REQUIRED

The following equipment should be available for use

1. Operating tables with appropriate weight limits and ability to ramp patient (see table below)
2. Extra side supports and straps to fit the operating table
3. Hover Mattress
4. Large flowtron boots
5. Large BP cuffs
6. Long needles for regional or neuraxial anaesthesia
7. Oxford HELP
8. Step for patient and anaesthetist
9. Bariatric ward beds for post-operative care should consider patient girth as well as weight.

Operating table make	Max weight without restrictions	Max weight with restrictions	What are the restrictions?
MAQUET ALPHA MAX	UP TO 250KG	250-450KG	1) DO NOT UNLOCK/MOVE THE TABLE. 2) REVERSE PATIENT ORIENTATION NOT PERMITTED. 3) LONGITUDINAL SHIFT NOT PERMITTED. 4) MAXIMUM PERMITTED INCLINATION +20 DEGRESS. 5) MAXIMUM PERMITTED LATERAL TILT +5 DEGREES. 6) MAXIMUM PERMITTED BACK PLATE ADJUSTMENT +80 DEGREES, -10 DEGREES. 7) BEACH CHAIR POSITION FOR ADIPOSITY SURGERY ONLY PERMITTED IF THE REQUIRED SUPPORTS ARE TAKEN INTO ACCOUNT.
ESCHMANN T20+ SERIES	UNDER 350KG	UP TO MAX 450KG	1) ONLY PERMITTED TO ADJUST THE HEIGHT OF THE TABLE . 2) CENTRE OF GRAVITY MUST LIE WITH IN THE BASE OF THE TABLE.
ESCHMANN T20-m+	0-200KG	PATIENT WEIGHT 200-300KG	TABLE SHOULD NOT BE MOVED, ONLY HEIGHT CAN BE MOVED
ESCHMANN T20-a+ and T20-s+	0-135KG	PATIENT WEIGHT 350-450KG PATIENT WEIGHT 135-350KG	TABLE SHOULD NOT BE MOVED, ONLY HEIGHT CAN BE MOVED TABLE SHOULD NOT BE MOVED, ALL TABLE ADJUSTMENTS CAN BE POWERED
GETINGE YUNO II (ORTHO THEATRES)	0-250KG	250- 454KG	1) DO NOT UNLOCK/MOVE THE TABLE. 2) REVERSE PATIENT ORIENTATION NOT PERMITTED. 3) LONGITUDINAL SHIFT NOT PERMITTED. 4) MAXIMUM PERMITTED INCLINATION +20 DEGRESS. 5) MAXIMUM PERMITTED LATERAL TILT +5 DEGREES. 6) MAXIMUM PERMITTED BACK PLATE ADJUSTMENT +80 DEGREES, -10 DEGREES. 7) BEACH CHAIR POSITION FOR ADIPOSITY SURGERY ONLY PERMITTED IF THE REQUIRED SUPPORTS ARE TAKEN INTO ACCOUNT.

WARD BED DIMENSIONS AND MAXIMUM PATIENT WEIGHTS

BED TYPE	MAX PATIENT WEIGHT	TOTAL BED LENGTH AND WIDTH
MEDSTROM SOLO	193KG	200CM(218CM EXTENDED) X 90CM
CENTRIUS PRO	220KG	200CM X 90CM
BARIATRIC BED	AWAITING CONFIRMATION	

PRE-OPERATIVE ASSESSMENT AND CONSENT

Patients identified as having a BMI >40 should be referred to High Risk Anaesthetic Clinic for medical review. The table below lists health conditions that may co-exist in the presence of morbid obesity and should be identified during pre-operative assessment, along with suggested investigations. Investigations should be requested on an individual patient basis and at the discretion of the requesting clinician. Optimisation of untreated or uncontrolled disease should occur prior to surgery if time permits by the named surgical Consultant and team

System	Disorder/Diagnosis	Investigation
Respiratory	Sleep Disordered Breathing (OSA/OHS) Asthma	ABG Sleep Studies/STOP-BANG Score (http://www.stopbang.ca/osa/screening.php) Spirometry CPET
Cardiovascular	Hypertension Left Ventricular Hypertrophy Left Ventricular Failure Conduction Abnormalities Cardiomyopathy Right Heart Failure	ECG Echocardiogram CPET Cardiology referral
Metabolic	Diabetes Mellitus Liver Involvement (NASH, NAFLD) Metabolic Syndrome	HbA1c Serum glucose LFTs Cholesterol
Thromboembolic	Previous DVT or PE	As per haematology advice

MANAGEMENT OF NEWLY DIAGNOSED OSA/OHS

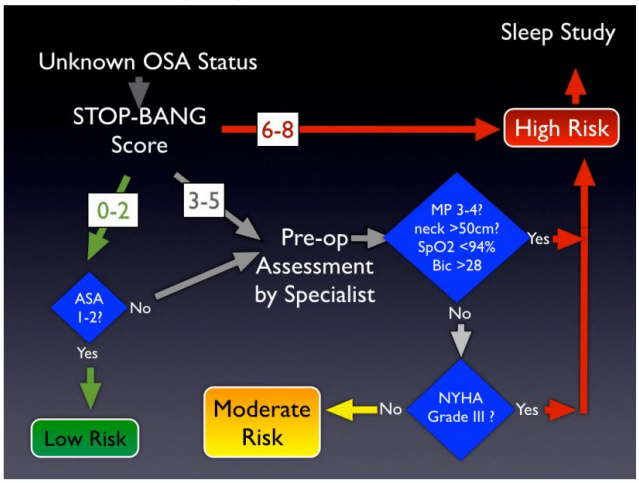
OSA and OHS are common and occur in 30-50% of the bariatric surgical patient population. Patients with untreated or undiagnosed OSA/OHS are at increased risk of cardiorespiratory complications (respiratory failure, pulmonary hypertension and heart failure).

It is important to identify and optimise these patients prior to surgery to reduce their peri-operative risk, if time allows.

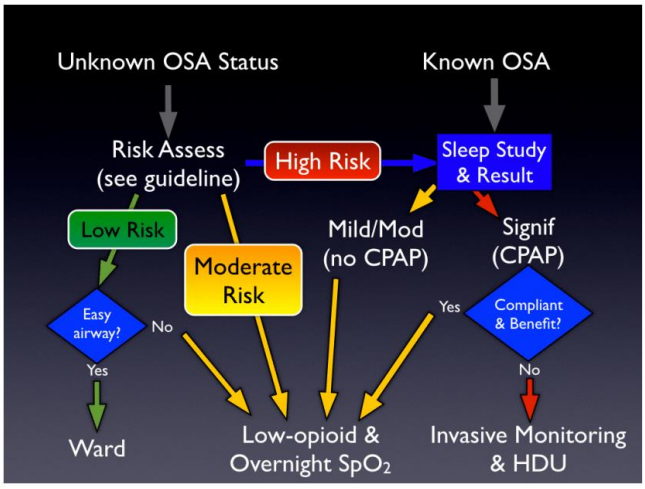
Below is a screening algorithm created by SOBA-UK for the identification and management of OSA pre-operatively.

SOBA UK Consensus Document

1 - OSA Screening Algorithm for the Obese Patient



2 - OSA Management algorithm for the Obese Patient



MM, JC, ES, Feb 2016

CONSENT FOR ANAESTHESIA

Key Factors include;

- Avoid inadvertent ‘fat shaming’
- Use first-person language. For example, ‘person living with obesity’, rather than ‘obese patient’
- Use neutral terms such as ‘unhealthy weight’ or ‘BMI’ instead of ‘fatness’ or ‘obesity’

Suggested risks and/or aspects to discuss pre-operatively;

- Consider asking the patient to shave their beard
- Explained sitting/ramped position for anaesthesia
- Intubation usually required
- Accidental awareness more common in patients with high BMI and recall (remembering removal of ETT)
- Vascular access and regional blocks more technically difficult (may need ultrasound)
- Ensure patient understands changes to diabetes management if applicable
- Day case surgery not definitely contraindicated
- Provide an information leaflet if possible outlining anaesthetic risks

SUITABILITY FOR DAYCASE SURGERY

Day case surgery can be undertaken safely in patients with Morbidy Obesity. This decision should be made by a senior clinician based on careful consideration of a number factors listed below.

Patients should be admitted to hospital if they do not satisfy specific discharge criteria.

There is an increased risk of complications in patients with BMI >50, therefore we do not suggest daycase surgery for these patients.

Patient Factors
Good functional capacity OSA/OHS effectively treated by CPAP/NIV Able to continue VTE prophylaxis at home if required
Anaesthetic Factors
Adequate time on list to anaesthetise Regional anaesthesia possible Experienced anaesthetic, operating theatre and day-case ward team
Surgical Factors
Adequate time on operating list to perform surgery, taking into account expected time to discharge Appropriate equipment for surgery and postoperative care available

ANAESTHETIC MANAGEMENT

General considerations

1. Experienced anaesthetic and surgical staff should manage patients with additional experienced support readily available.
2. Anaesthetising the patient in the operating theatre should be considered.
3. Regional anaesthesia is recommended as desirable but is often technically difficult and may be impossible to achieve.
4. A robust airway strategy must be planned and discussed, as desaturation occurs quickly in the obese patient and airway management can be difficult.
5. Use of the ramped or sitting position is recommended as an aid to induction and recovery.
6. Drug dosing should generally be based upon lean body weight and titrated to effect, rather than dosed to total body weight.
7. Caution is required with the use of long-acting opioids and sedatives.
8. Neuromuscular monitoring should always be used whenever neuromuscular blocking drugs are used.
9. Depth of anaesthesia monitoring should be considered, especially when total intravenous anaesthesia is used in conjunction with neuromuscular blocking drugs.
10. Appropriate prophylaxis against venous thromboembolism (VTE) and early mobilisation are recommended since the incidence of venous thromboembolism is increased in the obese.
11. Consider antacid premedication

Induction and maintenance of anaesthesia

1. Patient to self-position on operating table (on hover mattress if available for post-op moving and positioning)
2. Use correct size BP cuff
3. Special attention to protect pressure areas to avoid ischaemic injury.
4. Ultrasound may be needed to gain vascular access and for regional anaesthesia
5. Induce in head-up ramped position (ear tragus level with sternal notch horizontally)
6. Consider CPAP and/or HFNO
7. Preoxygenate well until P_EO_2 is >0.9 ideally
8. Tracheal intubation is recommended
9. Standard and advanced airway equipment should available (for example videolaryngoscope, fibreoptic endoscope) although no specific devices for obese patients
10. Caution strongly advised with Supraglottic Airway Devices (SAD) in BMI >40
11. Avoid spontaneous ventilation
12. May require high PEEP (8-10cmH20) to aid oxygenation
13. RSI not routinely required unless known risk factors (e.g unfasted, hiatus hernia)
14. Ensure adequate dosing of IV anaesthetic agent and prompt delivery of maintentance anaesthetic agent to avoid awareness at the point of airway manipulation. (see details regarding drug dosing in the section below)
15. Use short-acting volatile or TIVA
16. Suggest short-acting opioids & multimodal analgesia

Extubation

1. Preoxygenate prior to extubation with 100% oxygen until P_EO_2 is >0.9
2. Ensure full neuromuscular blockade reversal
3. Extubate and recover sitting up

POST-OPERATIVE MANAGEMENT

Postoperative Intensive Care or High Dependency support should be considered.

General considerations
Recovery in 30-45 degree head up position Early post-operative CPAP if required Postoperative Intensive Care or HDU support should be considered.
PACU discharge criteria
Usual discharge criteria should be met (no set minimum time in recovery) SpO2 should be maintained at pre-op levels with minimal O2 therapy No evidence of hypoventilation
OSAS or Obesity Hypoventilation Syndrome
Avoid sedatives and post-op opioids Reinstate patient's own CPAP if applicable with additional time in recovery until free of apnoeas without stimulation Patients untreated, intolerant of CPAP or ineffectively treated (persistent symptoms) are at risk of hypoventilation IV opioids should be avoided but, if necessary, patient should have continuous SpO2 monitoring, and level 2 care must be considered
General good ward level practice
Multimodal analgesia Caution with long-acting opioids and sedatives Early mobilisation Robust thromboprophylaxis regime Experienced Review post-op by surgical team

DRUG DOSING

Drug dosing for patients with Morbid Obesity will require adjustment. This depends on the drug and method of administration (bolus or infusion).

The SOBA UK group have developed an app which can be easily used to calculate drug doses for patients with a BMI >35. A summary of suggested doses are included below.

DEFINITIONS AND FORMULAE

Total Body Weight (TBW)	measured weight in kg
Ideal Body Weight (IBW)	Male = 50 + 0.9*(height (cm) – 152) Female = 45.5 + 0.9*(height (cm) – 152)
Lean Body Weight (LBW)	Male = 9270 x TBW/6680+(216 x BMI) Female = 9270 x TBW/8780 + (244 x BMI) (LBW peaks at 70kg for women and 100kg for men)
Adjusted Body Weight (Adj40BW)	IBW + 40% of extra

COMMON DRUGS AND SUGGESTED DOSING

Lean Body Weight
Propofol induction
Thiopentone
Fentanyl and Alfentanil
Morphine
Non-depolarising NMBDs
Paracetamol
Local Anaesthetics
Adjusted Body Weight
Propofol and remifentanil infusions
Neostigmine (max 5mg)
Sugammadex (read pack insert)
Total Body Weight
Suxamethonium
LMWHs
Antibiotics

Education and Training

MDT departmental teaching on this subject to raise awareness of management described above.

Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
Unexpected admission to HDU/ITU due to post-operative respiratory failure	Audit of unexpected admission to HDU		Annually	
Quality of recovery and length of stay in the morbidly obese surgical patient	Quality improvement project regarding quality indicators for recovery and measurement of length of stay compared with non-obese patients.		Continuous	
Unexpected admission following planned daycase surgery for patients with morbid obesity	Quality Improvement project measuring unexpected admissions following planned daycase surgery for patients with morbid obesity		Continuous	

Supporting References (maximum of 3)

https://www.bjaed.org/action/showPdf?pii=S2058-5349%2820%2930095-0

https://anaesthetists.org/Home/Resources-publications/Guidelines/Peri-operative-management-of-the-obese-surgical-patient

https://www.sobauk.co.uk/_files/ugd/373d41_eebe369c3c6b4021bff6f3da059aa796.pdf

Key Words

List of words, phrases that may be used by staff searching for the Guidelines on PAGL.

'Anaesthesia' 'Anaesthetic' 'Obesity' 'Morbidly Obese' 'High BMI' 'Bariatric Surgery'

CONTACT AND REVIEW DETAILS	
Guideline Authors and Lead **Dr Kathleen Wolff (ST7 Anaesthetist)** **Dr Susan Anderson (Consultant Anaesthetist)**	**Executive Lead** Dr Susan Anderson (Consultant Anaesthetist)
Details of Changes made during review: New guideline	

Anaesthesia for Patients Living with Obesity

Society for Obesity and Bariatric Anaesthesia

Pre-operative Evaluation

Red Flags
- Poor functional capacity
- Abnormal ECG
- Uncontrolled BP, CCF or IHD
- SpO_2 <94% on air
- If bicarbonate >27, OHS likely
- Previous DVT/PE
- STOP-BANG ≥ 5
- OS-MRS >3
- Metabolic Syndrome

Yes →
Consider:
- Preoperative CPAP
- Blood Gases / Sleep Studies
- Echocardiogram
- Cardiorespiratory referral
- Experienced Anaesthetist
- Book HDU Bed

No →
- May be suitable for day-case surgery

OS-MRS Calculator
tools.farmacologiaclinica.info

SOBA App
https://apps.apple.com/gb/app/soba-uk-app/id1549542383

STOPBANG Calculator
www.stopbang.ca

Central Obesity
(waist > half height)
- Difficult airway/ventilation more likely
- Greater risk of CVS disease/thrombosis
- Higher risk of metabolic syndrome

Peripheral Obesity
(Fat outside body cavity)
- Less co-morbidity
- Lower risk

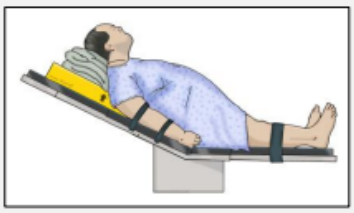
Intra-operative Management

Airway Equipment:
- Device or equipment for ramping
- Step for anaesthetist
- Difficult airway equipment
- Videolaryngoscope

Theatre Equipment:
- Suitable bed/trolley and operating table
- Gel padding
- Wide strapping and foot plates
- Table extensions/arm boards
- Hover mattress or equivalent
- Appropriately sized calf compression devices
- Sufficient staff to move patient

Other Anaesthesia Equipment:
- Ventilator capable of PEEP & pressure modes
- Long spinal, regional and vascular needles
- Ultrasound machine
- Forearm cuff or large BP cuff
- Depth of anaesthesia monitoring (EEG/BIS)
- Neuromuscular monitoring

Ramping



- Tragus level with sternum
- Reduces risk of difficult laryngoscopy
- Improves ventilation and pre-oxygenation

Induction:
- Self-position on operating table
- Consider premed antacid & analgesia
- Consider CPAP and/or HFNO
- Preoxygenate and intubate in ramped/sitting position
- Tracheal intubation recommended
- Caution with SAD in BMI >40
- Minimal induction to ventilation time

Intra-Op:
- DVT prophylaxis
- Commence maintenance promptly
- Increased risk of visceral injury when prone
- Avoid spontaneous ventilation, use PEEP
- Use short-acting inhalationals or TIVA
- Short-acting opioids & multimodal analgesia
- Think pressure areas

Extubation:
- Ensure full NMB reversal
- Extubate and recover sitting up

Lean Body Weight: This exceeds ideal body weight in patients with obesity and plateaus at:
- ≈100kg for a man
- ≈70kg for a woman

Ideal Body Weight: Broca formula
- Men: height (in cm) - 100
- Women: height (in cm) - 105

Adjusted Body Weight: Ideal plus 40% extra

If in doubt, titrate and monitor effect*

Suggested dosing for anaesthetic drugs

Lean Body Weight	Adjusted Body Weight	Total Body Weight
·Propofol induction	·Propofol Infusion	·Suxamethonium
·Thiopentone	·Neostigmine (max 5mg)	·LMWHs (titrate dose with Xa levels)
·Fentanyl and Alfentanil	·Sugammadex (read pack insert)	
·Morphine	·Antibiotics	
·Non-depolarising NMBDs		
·Paracetamol		
·Local Anaesthetics		

Post-operative Care

PACU discharge:
- Usual discharge criteria should be met
- SpO_2 should be maintained at pre-op levels with minimal O_2 therapy
- No evidence of hypoventilation

General good ward level practice includes:
- Multimodal analgesia
- Caution with long-acting opioids and sedatives
- Early mobilisation
- Robust thromboprophylaxis regime
- Experienced Consultant Review

OSAS or Obesity Hypoventilation Syndrome:
- Sit up and avoid sedatives and post-op opioids
- Reinstate patient's own CPAP if applicable with additional time in recovery until free of apnoeas without stimulation
- Patients untreated, intolerant of CPAP or ineffectively treated (persistent symptoms) are at risk of hypoventilation
- IV opioids should be avoided but, if necessary, patient should have continuous SpO_2 monitoring, and level 2 care must be considered

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