

ANAESTHESIA FOR CHILDREN LIVING WITH OBESITY

PRE-OPERATIVE

PRE-ASSESSMENT

Screen for co-morbidities	
CVS	Hypertension (QR1), cardiac dysfunction
Respiratory	OSA, asthma, smoke exposure
GI	Fatty liver disease (NAFLD), GORD
Endocrine	Insulin resistance, Type II DM
Other	2° causes of obesity, metabolic syndrome, psychological

Investigations to consider:
 ⇒ Fasting blood tests: Glucose + insulin, HbA1c, LFTs, TFTs, lipid profile, Vitamin D
 ⇒ Sleep study, ECG, echocardiogram, spirometry

- Refer to paediatric specialists if necessary
- Perform full airway assessment
- Safeguarding concerns?

DEFINING OBESITY

BMI = WEIGHT (kg) / HEIGHT (m)²

⇒ Determine BMI centile
 ⇒ Establish weight category

BMI centile	Weight category	ASA
> 91st	Overweight	2
> 98th	Obese	2
> 99.6th	Severely obese	3

Royal College of Paediatrics and Child Health BMI charts (QR2)
 Easy calculator app: Growth Charts UK-WHO (QR3)

CONSENT

- ↑ likelihood of critical events, "higher risk"
- Encourage shared decision making (QR4)
- Avoid negative language

PRE-MEDICATION

Drug (dose adjustment)	Time before GA
Dexmedetomidine (AdjBW) • IN 2-3mcg/kg (max 150mcg)	30-60 minutes
Ketamine (IBW) • PO 5-10mg/kg • IM 5mg/kg	10-20 minutes 3-5 minutes
Midazolam (TBW)* • PO 0.5mg/kg (max 20mg) • Buccal 0.3mg/kg (max 10mg)	15-30 minutes 10-15 minutes

IMPORTANT: ↓ dose if combining pre-medications

* **Midazolam:** risk of airway obstruction in OSA
 Consider risks versus specific benefits
 In severe OSA, reduce dose to 0.25mg/kg

PREVENTATIVE MEDICINE: Offer lifestyle advice. Refer to Tier 2 community programme / Tier 3 CEW clinic (QR 5) / dietician

INTRA-OPERATIVE

INDUCTION

Intravenous	Gas
Preferable BUT may be difficult. Consider: • Topical analgesia (hands, volar aspect wrist) • USS guidance / IO availability	• May take longer due to airway obstruction • Use O ₂ and volatile • Avoid nitrous oxide

✓ The priority is to secure the airway in a rapid but controlled manner

AIRWAY

- Consider pre-oxygenation where tolerated (FM / HFNO / nasal cannulae)
- Airway obstruction under GA IS more common
- Difficult facemask ventilation IS more common in obese (3.7%) vs healthy weight children (0.6%) (QR6)
- Use oropharyngeal airway +/- two-person technique
- 1st line endotracheal intubation with videolaryngoscopy
- Difficult intubation is NOT more common
- Obesity in isolation is NOT an indication for rapid sequence induction
- Decompress the stomach with a nasogastric / orogastric tube
- If a supraglottic airway is appropriate, consider 2nd generation (TBW)

VENTILATION

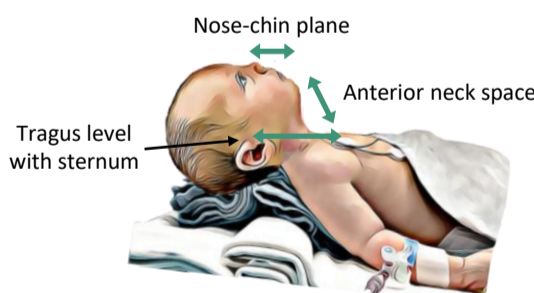
- Pressure control ventilation 6-8ml/kg (IBW) to limit barotrauma
- Optimise PEEP to compensate for reduced FRC
- Pressure support if spontaneously ventilating with supraglottic airway

POSITIONING + EQUIPMENT

"Ramp" the patient with pillows / Oxford HELP® pillow at induction.

Discuss any additional equipment at team brief:

- Table extenders
- Transfer board and slide sheet
- Hover mattress >90kg
- Gel padding
- Correctly sized / forearm BP cuff
- Arterial line
- Wide straps
- Anti-embolism stockings if >40kg
- Intermittent pneumatic compression (IPC) devices if >13 years old and >40kg and surgery >60 minutes (QR8)



Ramped position

↓ risk of difficult laryngoscopy + improves ventilation

TIVA

- Titrate to effect
- Use depth of anaesthesia monitoring
- Follow AAGBI / SIVA good practice guidance (QR9)

DRUG DOSING

- Recommend use of www.paedspro.com (QR7) to reduce risk of drug calculation errors
- Do not exceed maximum adult doses

Ideal body weight (IBW)	Adjusted body weight (AdjBW)
BMI ₅₀ x height (m) ²	IBW + 0.35 x (TBW - IBW)

BMI₅₀ is the age and sex-specific BMI at the 50th BMI centile

Total (TBW)	Ideal (IBW)	Adjusted (AdjBW)
Atropine	Propofol [induction bolus]	Propofol [TCI infusion]
Glycopyrrolate	Ketamine	Alfentanil
Dexamethasone	Morphine	Fentanyl
Ondansetron	Non-depolarising	Remifentanyl
Suxamethonium	muscle relaxants	[Minto infusion]
Penicillins	Dexmedetomidine [IV]	Dexmedetomidine [IN]
Cephalosporins	Local anaesthetics	Ibuprofen
Sugammadex	Adrenaline	Gentamicin
Neostigmine	Phenylephrine	Paracetamol
Enoxaparin		

ANALGESIA

- Use a multimodal approach
- Avoid long-acting opiates in severe OSA. Titrate to clinical effect.
- Use opioid sparing techniques: US guided regional anaesthesia, analgesic adjuncts (e.g. dexamethasone, dexmedetomidine)
- Opioid PCAs are safe to use but refer to drug dose adjustments above

POST-OPERATIVE

EMERGENCY

- ↑ FiO₂ and more upright positioning
- Full reversal with neuromuscular monitoring
- Awake extubation recommended
- Insert soft bite block e.g. rolled gauze (QR10)
- No evidence that obesity increases PONV risk
- NIV should be readily available
- Usual PACU discharge criteria should be met
- SpO₂ should be maintained at pre-operative levels with minimal O₂

VTE PROPHYLAXIS

- Perform risk assessment + follow guidance.

Total body weight (TBW)	Subcutaneous enoxaparin dose
<45kg	0.5mg/kg BD (max 40mg/day)
45-100kg	40mg OD
100-150kg	40mg BD
>150kg	60mg BD

- Limited literature available
- Low threshold for consulting haematologist

OTHER

- Prioritise early mobilisation where possible
- Ensure good hydration
- BM monitoring if insulin resistance / T2DM

Day case versus inpatient care

- Surgery and comorbidity dependent
- Consider need for higher level care e.g. HDU
- Obesity as a sole co-morbidity does not preclude day case surgery. If day case, allow prolonged post-operative observation (AM list).

For guidance ONLY, not a substitute for experienced clinical judgment. Always consult local policy where available.



QR1



QR2



QR3



QR4



QR5



QR6



QR7



QR8



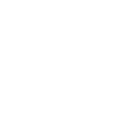
QR9



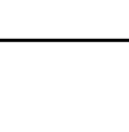
QR10



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QR10

QR CODES

QR CODES

QR CODES

QR CODES & REFERENCES



QR1 Screening for hypertension in children

Flynn JT, Kaelber DC, Baker-Smith CM et al. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics*. 2017; 140 (3). Available from: <https://publications.aap.org/pediatrics/article/140/3/e20171904/38358/Clinical-Practice-Guideline-for-Screening-and?autologincheck=redirected>

Table 1

New blood pressure classification for children, adolescents, and adults. (Modified from references 1 & 3)

HTN classification	Children aged 1-12 years (percentile based)	Everyone ≥ 13 y old (mm Hg based)
Normotensive	< 90th percentile	< 120/<80
Elevated blood pressure	≥ 90th percentile or ≥ 120/80 mm Hg (lower) to < 95th percentile	120-129/< 80
Stage 1 hypertension	≥ 95th percentile to < 95th percentile + 12 mm Hg or 130/80 to 139/89 (lower)	130-139/80-89
Stage 2 hypertension	≥ 95th percentile + 12 mm Hg or ≥ 140/90 (lower)	≥ 140/90



QR2 BMI growth charts

Royal College of Paediatrics and Child Health. *Body Mass Index 2-20 years*. 2013. Available from: https://www.rcpch.ac.uk/sites/default/files/2018-03/boys_and_girls_bmi_chart.pdf [Accessed 29th May 2024].



QR3 Growth Charts UK-WHO app calculator

Available in iOS: <https://apps.apple.com/gb/app/growth-charts-uk-who/id916579608>
Also available on Android.



QR4 SOBA guide to "Anaesthesia consent children and young people living with obesity"

The Society for Obesity and Bariatric Anaesthesia. Anaesthesia consent for children and young people living with obesity. 2023. Available from: https://www.sobauk.co.uk/files/ugd/373d41_98467b53ac284e17a0c70738133c7779.pdf?index=true [Accessed 13th June 2024].



QR5 Complications from excess weight (CEW) clinics for children in England

NHS England. Complications from excess weight (CEW) clinic for children. Available from: <https://www.england.nhs.uk/get-involved/cyp/specialist-clinics-for-children-and-young-people-living-with-obesity/> [Accessed 13th June 2024].



QR6 The PEACHY Study

Burton ZA, Lewis R, Bennett T, McLernon DJ, Paediatric Anaesthesia Trainee Research Network, Engelhardt T, Brooks PB, Edwards MR. Prevalence of Perioperative Childhood obesity in children undergoing general anaesthesia in the UK: a prospective, multicentre, observational cohort study. *Br J Anaesth* 2021. 127(6); 953-961. Available from: [https://www.bjanaesthesia.org/article/S0007-0912\(21\)00548-1/pdf](https://www.bjanaesthesia.org/article/S0007-0912(21)00548-1/pdf)



QR7 Paeds Prescribing pro drug calculator

Online drug dosing calculator for children living with excess weight, supported by SOBA, the Neonatal and Paediatric Pharmacists Group (NPPG) and the Association of Paediatric Anaesthetists of Great Britain and Ireland (APAGBI). 2023. Available from: www.paedspro.com and in App format on Android.



QR8 APAGBI VTE thromboprophylaxis guideline

Association of Paediatric Anaesthetists of Great Britain and Ireland. Guideline on the Prevention of Peri-operative Venous Thromboembolism in Paediatric Patients 2018. Available from: <https://www.apagbi.org.uk/sites/default/files/inline-files/APA%20Thromboprophylaxis%20guidelines%20final.pdf> [Accessed June 12th 2024].



QR9 TIVA safe practice guidelines

Joint Guidelines from the Association of Anaesthetists and the Society for Intravenous Anaesthesia. Guidelines for the safe practice of total intravenous anaesthesia (TIVA). Anaesthesia. [Internet]. 2019. Available from: [https://siva.ac.uk/joom2/images/pdf/teaching/Guidelines%20for%20the%20safe%20practice%20of%20total%20intravenous%20Anaesthesia%20\(TIVA\).pdf](https://siva.ac.uk/joom2/images/pdf/teaching/Guidelines%20for%20the%20safe%20practice%20of%20total%20intravenous%20Anaesthesia%20(TIVA).pdf) [Accessed June 12th 2024].



QR10 DAS Extubation guidelines

The Difficult Airway Society. Extubation Algorithm. 2011. Available from: <https://das.uk.com/content/das-extubation-guidelines> [Accessed June 12th 2024].

REFERENCES

Induction, Airway, Ventilation

Association of Anaesthetists of Great Britain and Ireland. Peri-operative management of the obese surgical patient 2015. *Anaesthesia*. [Internet]. 2015. 70; 859–876. Available from: <http://onlinelibrary.wiley.com/enhanced/doi/10.1111/anae.13101/>

Burton Z, Lewis R, Bennett T, McLernon D.J, Paediatric Anaesthesia Trainee Research Network, Engelhardt T, Brooks P.B, Edwards M.R. Prevalence of Perioperative Childhood obesity in children undergoing general anaesthesia in the UK: a prospective, multicentre, observational cohort study. *Br J Anaesth*. [Internet]. 2021. Available from: [https://www.bjanaesthesia.org/article/S0007-0912\(21\)00548-1/pdf](https://www.bjanaesthesia.org/article/S0007-0912(21)00548-1/pdf)

El-Metainy S, Ghoneim T, Arida E, et al. Incidence of perioperative adverse events in obese children undergoing elective general surgery, *Br J Anaesth*, 2011, vol. 106 (pg. 359-63)

Kim HJ, Park MJ, Kim JT, Kim CS, Kim SD, Kim HS. Appropriate laryngeal mask airway size for overweight and underweight children. *Anaesthesia*. [Internet]. 2010. 65; 50-53. Available from: <https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2044.2009.06160.x>

Nafiu OO, Reynolds P, Bamgbade OA, et al. Childhood body mass index and perioperative complications, *Paediatr Anaesth*, 2007, vol. 17 (pg. 426-30) 10.1111/j.1460-9592.2006.02140.x

Owen J, John R. Childhood obesity and the anaesthetist, *Continuing Education in Anaesthesia Critical Care & Pain*, Volume 12, Issue 4, August 2012, Pages 169–175.

Drug dosing

Adrenaline¹, Alfentanil, Atropine¹, Dexmedetomidine, Dexamethasone², Enoxaparin², Fentanyl², Ibuprofen^{1,2,3}, Ketamine¹, Local anaesthetics⁴, Midazolam^{2,5,6}, Morphine^{2,7,8,9}, Neostigmine^{1,5,9}, Non depolarizing muscle relaxants^{5,7,4}, Ondansetron², Paracetamol^{1,2,3}, Penicillins², Phenylephrine¹, Propofol (induction)^{5,7,8}, Propofol infusion¹⁰, Remifentanil infusion^{11,12}, Sugammadex^{7,13,14}, Suxamethonium^{5,7,8,9}

(1) Ross EL, Heizer J, Mixon MA, et al. Development of recommendations for dosing of commonly prescribed medications in critically ill obese children. *Am J Health Syst Pharm*. [Internet] 2015; 72(7): 542-56. Available from: <https://academic.oup.com/ajhp/article-abstract/72/7/542/5111678?redirectedFrom=fulltext>

(2) Specialist Pharmacy Service. UK Medicines Information (UKMi) pharmacists with input from the Neonatal and Paediatric Pharmacists Group (NPPG) for NHS healthcare professionals. *How should medicines be dose in children who are obese*. 2021. Available from: <https://www.sps.nhs.uk/articles/how-should-medicines-be-dosed-in-children-who-are-obese/>

(3) Guidelines for treating acute pain in paediatric inpatients. Acute Paediatric Pain Service February 2018. Barts Health NHS Trust.

(4) Joint Formulary Committee. *British National Formulary* (online) London: BMJ Group and Pharmaceutical Press. Available from: <https://bnfc.nice.org.uk>.

(5) Chidambaran V, Tewari A, Mahmoud M. Anesthetic and pharmacologic considerations in perioperative care of obese children. *J. Clin. Anesth*. [Internet] 2018. 45: 39-50. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S0952818017310899>

(6) Kyler, K, Wagner J, Hosey-Cojocari C, Watt K, Shakhnovich V. Drug Dose Selection in Pediatric Obesity: Available Information for the Most Commonly Prescribed Drugs to Children. *Paediatr drugs*. [Internet] 2019, 21(5): 357–369. Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7681556/>

(7) Mortensen A, Lenz K, Abildstrøm H, Lauritsen T.L.B. Anesthetizing the obese child. *Paediatr Anaesth*. [Internet]. 2011. 21; (6); 623-629. Available from: <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1460-9592.2011.03559.x>

(8) Brzenski A, Dontukurthy S, Raman V. T. Challenges of pediatric obesity in perioperative care. *Int. Anesthesiol Clin*. [Internet] 2020. 58; (3); 9-13. Available from: https://journals.lww.com/anesthesiaclinics/Citation/2020/05830/Challenges_of_pediatric_obesity_in_perioperative.2.aspx

(9) Burke C.N, Voepel- Lewis T, Wagner W, Lau I, Baldock A, Malviya S et al. A retrospective description of anesthetic medication dosing in overweight and obese children. *Paediatr. Anaesth*. [Internet]. 2014. 24;(8); 857-862. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/pan.12396>

(10) Masaracchia MM, Lee M, Dalesio NM. Obesity in childhood. *BJA Educ*. [Internet]. 2022. (5); 169-175. Available from: [https://www.bjaed.org/article/S2058-5349\(22\)00007-5/fulltext#relatedArticles](https://www.bjaed.org/article/S2058-5349(22)00007-5/fulltext#relatedArticles)

(11) Kim TK, Obara S, Egan TD. Disposition of remifentanil in obesity: A new pharmacokinetic model incorporating influence of body mass. *Anesthesiology*. 2017. 126; 1019-1032

(12) Shafer SL, Fisher DM. Remifentanil dosing at extremes of body weight. *Anesthesiology*. 2017. 126(6); 993-994.

(13) Bridion®. (Sugammadex) Merck Sharp and Dohme Ltd. Summary of Product Characteristics. [Internet]. Available from www.medicines.org.uk.

(14) United Kingdom Clinical Pharmacy Association, Critical Care Group. Drug dosing in extremes of body weight in critically ill patients, 1st edition. [Internet]. September 2013. Available from <https://www.scottishintensivecare.org.uk/uploads/2014-07-24-19-55-33-Drugdosingatextremesofbod-45662.pdf>.

Post operative

Association of Paediatric Anaesthetists of Great Britain and Ireland. Guidelines on the prevention of post-operative vomiting in children 2016. [Internet]. Available from: <https://www.apagbi.org.uk/sites/default/files/inline-files/2016%20APA%20POV%20Guideline-2.pdf>