Western Health

Department of Anaesthesia, Pain and Peri-operative Medicine

Handbook of Paediatric Anaesthesia

Updated December 2023

Forward

This handbook has been produced by the Western Hospital Department of Anaesthesia and Pain Medicine to assist staff with paediatric anaesthesia. Along with local guidelines and procedure documents available on PROMPT, it should assist rotating trainees to be aware of local practices. Junior trainees are expected to conform to the guidelines closely and liaise with consultant anaesthetists regularly. These guidelines do not replace clinical judgment; the patient's best interest is always the first priority

Table of Contents

Paediatric Advice After Hours

The department provides a list of consultant anaesthetists who may be contacted to provide assistance with infants or difficult paediatric cases out of hours. They are members of the Paediatric Anaesthesia Special Interest Group. This is not an official on call roster, so discussion with your rostered consultant on-call is expected in the first instance. This list is published at the bottom of the published weekly roster and is meant to be read from left to right. The order randomly changes from week to week to spread the load.

Fasting Guidelines

Appropriate preoperative fasting reduces gastric volume and gastric acidity. This reduces the risk of gastro-oesophageal reflux and aspiration during anaesthesia. Although extremely rare in paediatrics, this may result in serious morbidity. This risk must be balanced against the risk of dehydration and hypoglycaemia in children with unnecessarily prolonged fasting.

Minimum *fasting times before elective surgery are as follows:*

For paediatric patients older than 6 months of age,
Solids, including all types of milk – 6 hours
Clear fluids – 1 hour

For paediatric patients younger than 6 months of age,
Solids, excluding milk – 6 hours
Non-human milk – 4 hours
Breast milk – 3hours
Clear fluids – 1 hour

Clear fluids (e.g. Apple juice, cordial, water, lemonade) are non-particulate and transparent.
A good rule of thumb is that newsprint can be read through clear fluids.
Orange juice is <u>not</u> a clear fluid.

For emergency cases, the in-charge anaesthetist will advise regarding fasting on an individual case basis.

Many children are inadvertently overfasted – on average 8-10 hours for fluids. The risk of aspiration must be balanced against the risk of dehydration and hypoglycaemia in children with unnecessarily prolonged fasting. Please remember to offer clear fluids up to 1 hour pre op.

Parental/Carer Presence in Theatre

Induction of anaesthesia can be an anxious time for both children and their parents/carers. It is generally agreed that children suffer separation anxiety from around 9 months of age and older. For children older than 9 - 12 months, parental/carer presence at induction may help to alleviate anxiety in the child (and the parent). Parental/carer presence in the anaesthetic room or operating theatre remains at the discretion of the anaesthetist. The aim of parental/carer presence is to assist in the smooth induction of the child and is not mandatory. In some situations, such as where the parent/carer is extremely upset, it would not be helpful to the child.

The nursing staff in the holding area will help the parent/carer cover street clothes with gown, overshoes and hat. The parent/carer must agree to leave the child once the child is anaesthetised, or when asked to leave by staff. The anaesthetist needs to predetermine that the parent/carer will comply with these requests prior to induction.

Due to limited physical space, usually only one parent/carer may accompany the child. An interpreter may be required if the parent/carer does not speak English. Anxiety in the child varies proportionally with the number of people in the room. This should be kept in mind during induction of anaesthesia. A staff member separate from the anaesthetic nurse and anaesthetist must be available to show the parent/carer from the theatre once the child is anaesthetised. This staff member should be allocated prior to induction.

Paediatric Patient Attire

We encourage patients to not be unnecessarily changed into theatre gowns for procedures unless absolutely required for exposure due to the potential distress this causes children and issues with temperature management. At WH the need for a theatre gown for surgical exposure is rare. Paediatric patients are encouraged to wear comfortable, loose-fitting clothes that provide sufficient access to the surgical site and for mandatory intra and post operative monitoring.

Pre-medication Guideline

General Premedication

For children aged > 6 months old, there is a standing order for nursing initiated paracetamol 30mg/kg orally and angel cream (amethocaine) topically preoperatively. Angel cream needs to be applied for 45 mins to have the anaesthetic effect.

For children aged <6 months old, any premedication is up to the discretion of the anaesthetist.

For children with anticipated long waiting times to theatre (e.g >1 hour), consider prescribing oral clear fluids eg. apple juice or cordial as premedication, to avoid prolonged fasting.

Sedative Premedication

Advantages	Disadvantages
Reduces child anxiety and may improve co-operation with induction of anaesthesia and anaesthetic experience	May distress child if unwilling to take oral premedication
Provides anterograde amnesia	Potentiates sedative effect of other drugs eg. opioids
	Potential paradoxical reaction (eg. midazolam causing agitation)

Indications	Contraindications
During the preoperative consultation, every child should be assessed for need for sedative premedication. The following children may benefit from sedative premedication: - Intellectual disability or developmental delay - Autism or Asperger's Syndrome - Behavioural issues eg. ADHD - Children with previous traumatic anaesthetic inductions - Children needing multiple operations - Children having major surgery	The following conditions require caution when prescribing sedative premedication and a risk benefit assessment needs to be made: - Anticipated difficult airway - Aspiration risk - Central or obstructive sleep apnoea - Impaired respiratory status - Decreased GCS - Acute systemic illness eg. severe sepsis - Previous adverse reaction to sedative premedication

General Considerations
- Confirm fasting status and aspiration risk - Inform parents and child of premedication and discuss possible effects to expect. Children are at risk of falls and need to be on the parent's lap or in a cot or trolley afterwards. - Chart premedication dose, route and time (may be "on call") - Inform nursing staff of premedication order

- Oral premedication can be given with a small volume of clear liquid (eg. apple juice, cordial or paracetamol mixture) to mask the unpleasant taste
- Sedative premedication is given in a safe monitored environment (either on paediatric ward or in preoperative holding bay or theatre) with continuous oxygen saturation monitoring, and within sight of nursing staff

Drug	Route	Dose	Onset (mins)	Duration (hours)	Note	Effects
Midazolam	Oral	0.5mg/kg (max 20mg)	20-30	1	Most commonly used Unpleasant taste	Sedation, anxiolysis, anterograde amnesia, paradoxical reaction in some children causing agitation
Temazepam	Oral	10-20mg	45-60	3	Use in older children	Sedation, anxiolysis, amnesia
Clonidine	Oral	4 mcg/kg	45-60	6	Bradycardia, hypotension Can use in children with previous paradoxical reaction to midazolam	Sedation, analgesia, anxiolysis but no amnesia
Ketamine	Oral	5mg/kg	10-20	3	Increased salivation, nystagmus, dissociative state	Sedation and analgesia
	Intramuscular*	3-5mg/kg	3-5	1-3		

* IM route may be useful in larger uncooperative children who will not take oral premedication eg. older autistic children. Discuss case with anaesthetic consultant prior to prescribing ketamine intramuscularly. Patient will need to have premedication given by anaesthetist in the operating theatre/preoperative holding bay on a trolley with monitoring facilities and access to airway equipment. NB: The oral clonidine and oral ketamine are given using the iv solution

Paediatric Analgesia Guidelines

Our aim is to keep our patients as comfortable as possible throughout the perioperative period. We employ multimodal analgesia to minimise side effects of any one modality.

A great resource for up to date information is the ANZCA Acute Pain Management: Scientific Evidence booklet with dedicated sections on paediatrics.

Pain assessment scales in children include:

FLACC score (see appendix)
Faces Pain Scale - Revised (see appendix)
Numeric rating scale (0 = no pain, 10 = most severe pain)

Simple Analgesia

Paracetamol

Loading dose: for children older than 6 months 30mg/kg, max 1g,oral paracetamol as per preop paediatric protocol will be given by paediatric nursing staff.
Subsequent dosing: Oral 15m/kg every 4 – 6 hours with a maximum daily dose of 60mg/kg . IV paracetamol is available for use in children who remain nil orally for more than a few hours
For neonates, maximum daily dose should not exceed 30mg/kg/day

Hepatotoxicity may occur with paracetamol overdosage. Restriction of daily dosage to less than 60mg/kg is necessary in children who are unwell, obese, malnourished, or fasting for prolonged periods. Obese children should have paracetamol dosing based on lean body weight (see Appendix). Adult dosing regimens should never be exceeded.

Rectal paracetamol has highly variable absorption and should not be used.

Non Steroidal Anti Inflammatory Drugs

Ibuprofen

Usual dose is 5 to 10 mg/kg (up to 400mg) every 4 to 6 hours.
Usual NSAID side effects including bleeding so check with ENT surgeon post-tonsillectomy.
Check with orthopaedic surgeon - ?effect on bone/callus formation.

Parecoxib

Little or no antiplatelet effects but still other NSAID side effects.
Usual dose is 1mg/kg (maximum of 40mg). Not widely used in small children.

Celecoxib

On Western Health formulary for use in day stay tonsillectomy patients. Dose is 4mg/kg, max 200mg bd.

Opioid Analgesia

Beware of opioid induced respiratory depression in young infants, and in children with sleep apnoea, in addition to the usual side effects of **sedation** and **constipation**.
Reportable respiratory rates:

Table 2: Age related reportable respiratory rates	
Age years	Breaths per minute
1 – 4	Report if less than 21
5 – 11	Report if less than 16
12 – 18	Report if less than 14

Opioids should be avoided in children at risk of sleep apnoea. Techniques to minimise opioid requirements, whilst maintaining good analgesia, should be used in these children. This may include regional blockade with concurrent simple analgesia +/- tramadol.

However, circumstances may arise where opioid administration is necessary. Such children should be monitored continuously with pulse oximetry. These children should be nursed in a location highly visible to staff at all times.

Excessive Post Operative Sedation may require naloxone 2microg/kg up to 5 doses.
Opioid Induced Ventilatory Impairment may require naloxone 10microg/kg IV. Repeat 2 minutely up to 5 doses, then IV infusion 10microg/kg/hr if needed

Codeine
No longer recommended for use in children. Metabolism to the active metabolite morphine is via the P450 CYP2D6 enzyme system. Immaturity of this enzyme system can result in diminished clinical efficacy. Ultra-rapid metabolisers of codeine may cause severe respiratory depression at routine dosage. This has been implicated in deaths of children post tonsillectomy.

Oxycodone
Oxycodone is available on hospital formulary as oxynorm liquid. Prescribe oxynorm liquid 0.1-0.2mg/kg 3 hourly PRN

Annotate prescription “DO NOT GIVE IF SEDATED”.

Tramadol
Although Tramadol is a weak opioid agonist, its main analgesic effects are due to effects on serotonin and noradrenaline in descending spinal pathways. Advantages include less sedation, respiratory depression and constipation compared to other opioid agonists. Significant respiratory depression has been associated with overdose of Tramadol. There is little evidence that respiratory depression is due to ultra rapid metabolism of Tramadol [1]
Tramadol is useful for the relief of pain uncontrolled by simple analgesia, or as a morphine-sparing agent in the management of severe pain.

SPANZA Advisory on Tramadol – May 2017
Usual dose is 0.5mg/kg every 6 to 8 hours (max. 2mg/kg/day). This dose should not be exceeded in children undergoing tonsillectomy, to prevent post operative respiratory depression associated with obstructive sleep apnoea.

For severe pain, a regular dosing of 1mg/kg every 6 to 8 hours (max 4mg/kg/day) can be used for a limited time.

Can cause nausea and vomiting, so give IV doses over 10 min

and oral doses with food.
Ondansetron may reduce the analgesic effect of Tramadol.
Tramadol is not widely used in infants

Intravenous opioids in theatre and recovery

For painful procedures not amenable to effective regional blockade, intravenous opioids are useful.

Typical intraoperative doses are as follows ***(based on lean body weight)***
Fentanyl 0.5 to 1.0 microgram/kg for minor procedures, and up to 3-4microgram/kg for more invasive procedures
Morphine 50 to 100 microgram/kg
Subsequent intraoperative bolus doses may be given if deemed necessary, but it may be prudent to wait until spontaneous respiration has returned.

Children have a propensity for postoperative nausea and vomiting, once opioids have been administered. Prophylactic anti-emetics should be considered.

Typical PRN intravenous opioids in paediatric recovery are

Morphine
0.1mg Morphine/kg diluted to 10ml with Normal Saline:
2ml bolus 5minutely prn x 5
This equates to a morphine bolus of 20 microgram/kg.

Fentanyl
1 microgram Fentanyl/kg diluted to 10ml with Normal Saline:
2ml bolus, 5 minutely prn x 5
This equates to a fentanyl bolus of 0.2 microgram/kg

Further analgesic requirements in PACU should be assessed by the anaesthetist.

Intravenous opioid infusions and PCA

All requests from outside theatre for PCA or opioid infusions for paediatric patients shall go through the anaesthetic registrar on call for Sunshine Hospital.
No other opioids are prescribed or administered concurrently with parenteral opioid analgesia.
Refer to Western Health Procedure: Patient Controlled Analgesia (PCA), Nurse Controlled Analgesia (NCA) and Continuous Opioid Infusion for paediatric patients 10-50kg.

Continuous Intravenous Opioid Infusion

The following standard prescription is prescribed on the EMR using the “PAED Intravenous Analgesia – PCA and Continuous PAED <50KG” EMR Orderset for appropriate patients with lean body mass between 10kg and 50kg. Patients with lean body mass greater than 50kg can be treated as an adult. Patients <10kg should be referred directly to a consultant Anaesthetist.

Enter the patient’s weight in the appropriate checkbox under the Continuous Details tab of the analgesic infusion prescription.

The REM Bodyguard Infusion Pumps is programmed using the paediatric drug library in mL (not mg) after the appropriate dilution based on weight.

Morphine: 1mg/kg made up to a total of 100mL Normal Saline (10 microg/kg/mL)
program REM Bodyguard infusion pump in mL (not mg)
intravenous infusion rate: 0 – 4mL/hr (0 – 40microg/kg/hr)

Fentanyl: 15microg/kg made up to a total of 100mL Normal Saline (0.15microg/kg/ml)
Program REM Bodyguard infusion pump in mL (not microg)
Intravenous infusion rate: 0 – 8mL/hr (0-1.2microg/kg/hr)

Preparation of the opioid analgesia infusion, and programming of the pump using the paediatric drug library, must be checked by a Consultant Anaesthetist, Anaesthetic Registrar, Recovery ANUM or the CNC/NP Pain Management.

Nurse Controlled Analgesia

For details, please refer to the Western Health Procedure: Patient Controlled Analgesia (PCA), Nurse Controlled Analgesia (NCA) and Continuous Opioid Infusion for Paediatric Patients 10-50kg Section 8.6.1.1
Where a patient is prescribed NCA, and Observation Criteria are met, a nurse may deliver a prescribed bolus dose of intravenous opioid by pressing the PCA button.

Patient Controlled Opioid Analgesia

Patient controlled analgesia (PCA) may be suitable for children with cognitive ability of early primary school level. Ideally, this should be assessed, and the technique discussed, at the pre-anaesthetic visit.

The following standard prescription is prescribed on the EMR using the "PAED Intravenous Analgesia – PCA and Continuous PAED <50kg" EMR Orderset for appropriate patients with **lean body mass less than 50kg**. *Patients with lean body mass >50kg can be treated as an adult.*
Enter the patient's weight in the appropriate checkbox under the Continuous Details tab of the analgesic infusion prescription.
The REM Bodyguard Infusion Pump is programmed using the paediatric drug library in ml (not mg) after the appropriate dilution based on weight.

Morphine
1mg/kg Morphine made up to a total of 100mL Normal Saline (10 microg/kg/mL)
program REM Bodyguard infusion pump in mL (not mg)

PCA bolus:	**dose of 2mL (20microg/kg)**
lock-out interval:	**5 minutes**
1 hour maximum:	**10mL (100 microg/kg)**
	= 5 bolus doses

Fentanyl
15microg/kg Fentanyl made up to a total of 100mL Normal Saline (0.15microg/kg/mL)
program REM Bodyguard infusion pump in mL (not mg)

PCA bolus dose :	**2 mL (0.3microg/kg)**
lock-out interval:	**5 minutes**
1 hour maximum:	**10mL (1.5 microg/kg)**
	=5 boluses

Preparation of the opioid analgesia infusion, and programming of the pump using the paediatric drug library, must be checked by a Consultant Anaesthetist, Anaesthetic Registrar, Recovery ANUM or the CNC/NP Pain Management.

Paediatric Regional Analgesia

Techniques using local anaesthesia +/- adjuvants can provide high quality analgesia and minimise dose-related side-effects of other analgesic modalities. Care must be taken to limit dosage per kg body weight to avoid local anaesthetic toxicity (central nervous and cardiovascular systems).

Local infiltration
Ensure communication with surgical colleagues regarding safe dosage limits if administered intraoperatively.
Levobupivacaine (0.25% & 0.5%, up to 2.5mg/kg) and
Ropivacaine (0.2% & 0.75% up to 3mg/kg)
are preferred to lignocaine as they last longer.
Adrenaline (up to 10microgram/ml) may be added to provide vasoconstriction to decrease bleeding, but must not be used on digits or appendages.

Caudal
Provides dose related neuraxial blockade for surgery involving perineum, lower limbs, and lower abdomen.
Infection in the epidural space is an extremely rare but undesirable risk.
To minimise this risk, Aseptic Non Touch Technique is employed including use of sterile equipment, sterile gloves, and alcoholic prep solution.
Levobupivacaine 0.25% up to 2.5mg/kg or Ropivacaine 0.2% up to 3mg/kg

Adjuvants
Adrenaline test dose for detection of intravascular injection:
Adrenaline 1:200,000 solution is made by freshly adding 0.1mL of Adrenaline 1:1,000 to 20ml of local anaesthetic solution (5 mcg/ml).
Following a test dose caudal injection of 0.1ml/kg of this freshly prepared solution, a heart rate rise of more than 10 beats/min within 15 to 30 seconds of injection is a sensitive and specific indicator for intravascular injection[3].

Clonidine 1 – 2 microgram/kg increases the duration of sensory blockade.
Beware of side effects of bradycardia, hypotension, and sedation.
These are all dose related, and particularly undesirable in small babies

Ilio-inguinal block
Safe easy block for covering the groin. Can be unilateral or bilateral.
“Caudle needle” is blunt and gives good feel for the “pops” as the 2 muscle layers are passed through..
Ropivacaine 0.75% up to 2mg/kg
Levobupivacaine 0.25%: ¼ ml/kg for each layer

Penile block
Useful for operations on distal penis when caudal is not used.
Use relatively blunt “Caudal needle” to feel “pop” through mebranous layer of superficial fascia.
Ropivacaine 0.5%: 1ml per side + 0.1ml/kg per side for patients > 10kg.

Ultrasound-guided Transversus Abdominus Plane block

TAP blocks may be performed in children for surgeries on the lower abdominal wall. Care must be taken to keep local anaesthetic dosage within safe limits to avoid toxicity.

Paediatric Midlines

The department offers a service to place Midline catheters under general anaesthesia to paediatric patients from 2 years of age.

These may be requested by orthopaedic surgery, plastic surgery and paediatric medicine for paediatric patients requiring prolonged administration of IV medications up to 29 days.

Bookings are taken by the Sunshine Anaesthetist In Charge.

The Paediatric Midline Catheter Booking Form is available for download from the Anaesthesia Department intranet website under Paediatric Midlines.
See the Anaesthetic Inserted Paediatric Midline Catheter Procedure Guideline on PROMPT for details of the midline booking, procedure, and aftercare.

The midline is placed in theatre.

Two anaesthetists are required: one to perform the procedure, and the other to provide anesthesia.
The Anaesthesia department administrative staff are responsible for allocation of anaesthesia staffing.

Management of Paediatric PONV

Postoperative vomiting in children is twice as frequent as in adults.
Nausea is difficult to assess in the young child.

Patient risk factors
previous history
no sex difference until puberty
risk is low for children < 2 years of age but increases with age.

Procedural risk factors
type of surgery: squint repair, adenotonsillectomy
Anaesthetic drugs: opioids, nitrous oxide, volatile agent

Prophylaxis of PONV
Presence of risk factors should prompt consideration of prophylactic measures against PONV:

- adequate hydration
- Multimodal analgesia to minimise opioid requirement
- Avoidance of nitrous oxide
- Oxygen supplementation (up to 80%)
- Consider total intravenous anaesthesia (consultant anaesthetist).

Moderate or high risk patients should receive prophylactic antiemetics from 2 to 3 different classes

Dexamethasone 0.15mg/kg max. 8mg at beginning of case
Ondansetron 0.15mg/kg IV max 4mg 20min prior to waking
Droperidol 10microg/kg IV max 625microg 20min prior to waking

Treatment of PONV

Ondansetron 0.15mg/kg IV, max 4mg, 8hrly
Metoclopramide 0.2mg/kg IV, max 10mg, over 10min, 6hrly
Consider:
Droperidol 10microgram/kg IV, max 625microgram, 8hrly
Cyclizine 0.5mg/kg IV, max 50mg, 8hrly
Promethazine 0.5mg/kg IV, max 25mg, 8hrly

Exclude inciting or mechanical factor eg. Opioid infusion, bowel obstruction.
IV hydration until tolerating oral fluids.

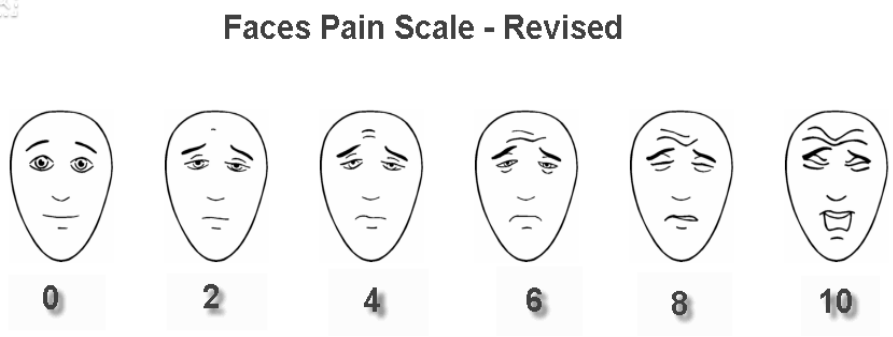
Patients requiring post-operative care in the special care nursery

Neonates are at increased risk in the early post-operative period due to their physiological immaturity and the added risks of
Potential fluid loss and deficit
Residual anaesthetic agents
Use of narcotics
Hypothermia
Fasting

Leading to the problems of
Apnoea
Hypoglycaemia
Cardiovascular collapse
Incorrect drug dosing

Neonates are a challenge to care for in the post-operative period and experience is best concentrated in one area, especially in a peripheral hospital such as Joan Kirner Women and Children's. Having "a set age criteria" must take into account the prematurity, birth weight and other significant history of the patient. As a base line we would use a post conceptual age of less than 44 weeks as a criteria for admission but in the end this is a complex medical decision. Admissions to the Special Care Nursery require referral to the duty neonatologist. Please check that a bed is available with the nurse in charge, providing as much warning as possible.

Appendix 1: Pain Scales



In the following instructions, say "hurt" or "pain," whichever seems right for a particular child.

"These faces show how much something can hurt. This face *[point to left-most face]* shows no pain. The faces show more and more pain *[point to each from left to right]* up to this one *[point to right-most face]* - it shows very much pain. Point to the face that shows how much you hurt [right now]."
Score the chosen face 0, 2, 4, 6, 8, or 10, counting left to right, so '0' = 'no pain' and '10' = 'very much pain.'
Do not use words like 'happy' and 'sad'. This scale is intended to measure how children feel inside, not how their face looks.

FLACC Score

CATEGORY	SCORE	DESCRIPTION
Face	0	No particular expression or smile
	1	Occasional grimace/frown, withdrawn or disinterested
	2	Frequent quivering chin, clenched jaw
Legs	0	Normal position or relaxed
	1	Uneasy, restless, tense
	2	Kicking or legs drawn up
Activity	0	lying quietly, normal position, moves easily
	1	Squirming, shifting back and forth, tense
	2	Arched, rigid or jerking
Cry	0	No cry
	1	Moans or whimpers, occasional complaint
	2	Crying steadily, screams, or sobs, frequent complaints
Consolability	0	Content and relaxed
	1	Reassured by occasional touching, hugging or talking, distractible
	2	Difficult to console or comfort

Appendix 2: Weight calculations in obese patients

Lean body weight calculation

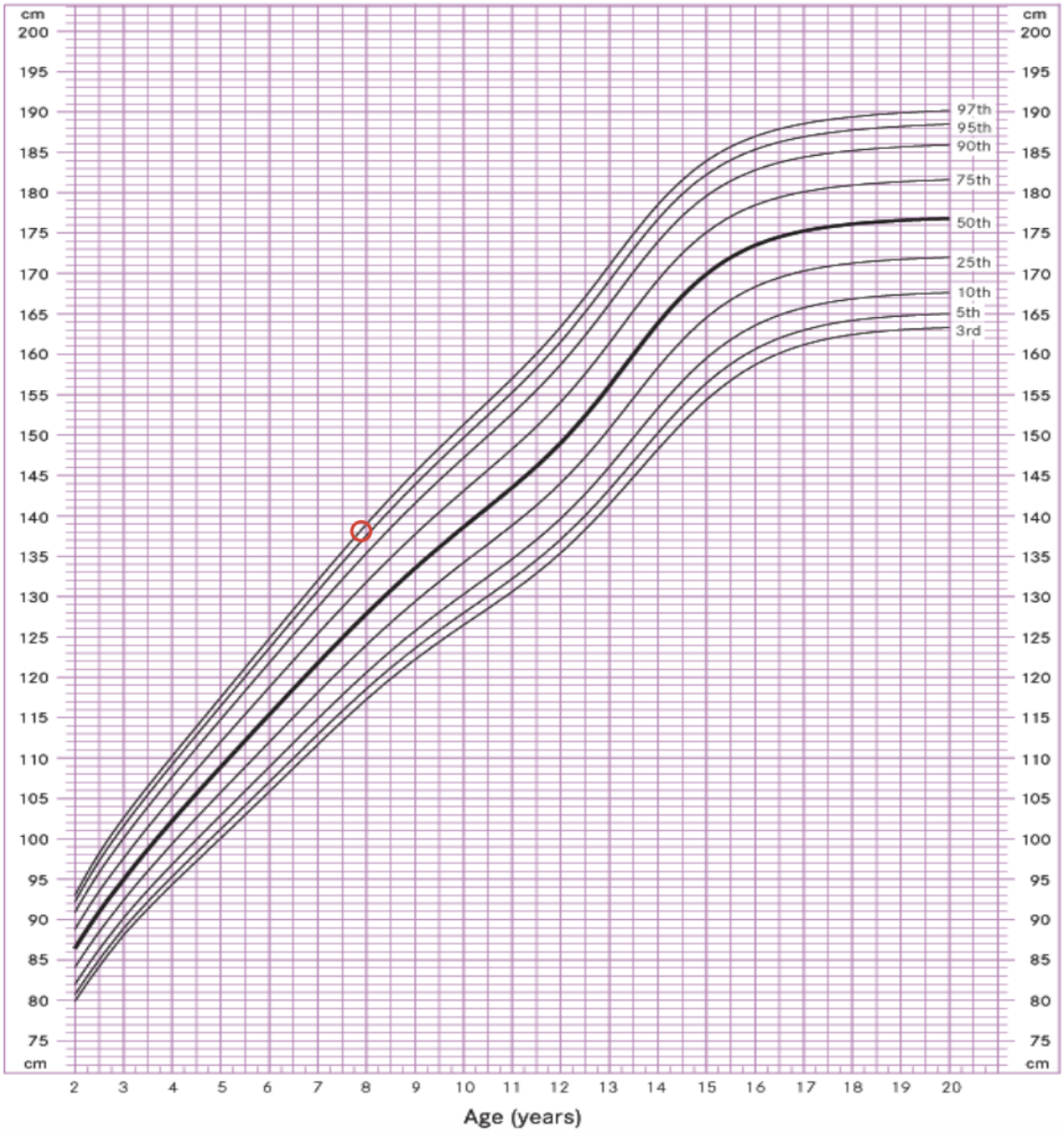
Lean body weight (males) = (1.1 x weight) – (0.0128 x BMI x weight)
Lean body weight (females) = (1.017 x weight) – (0.0148 x BMI x weight)
Body mass index (BMI) = weight (kg) / (height (m))2

Weight for height

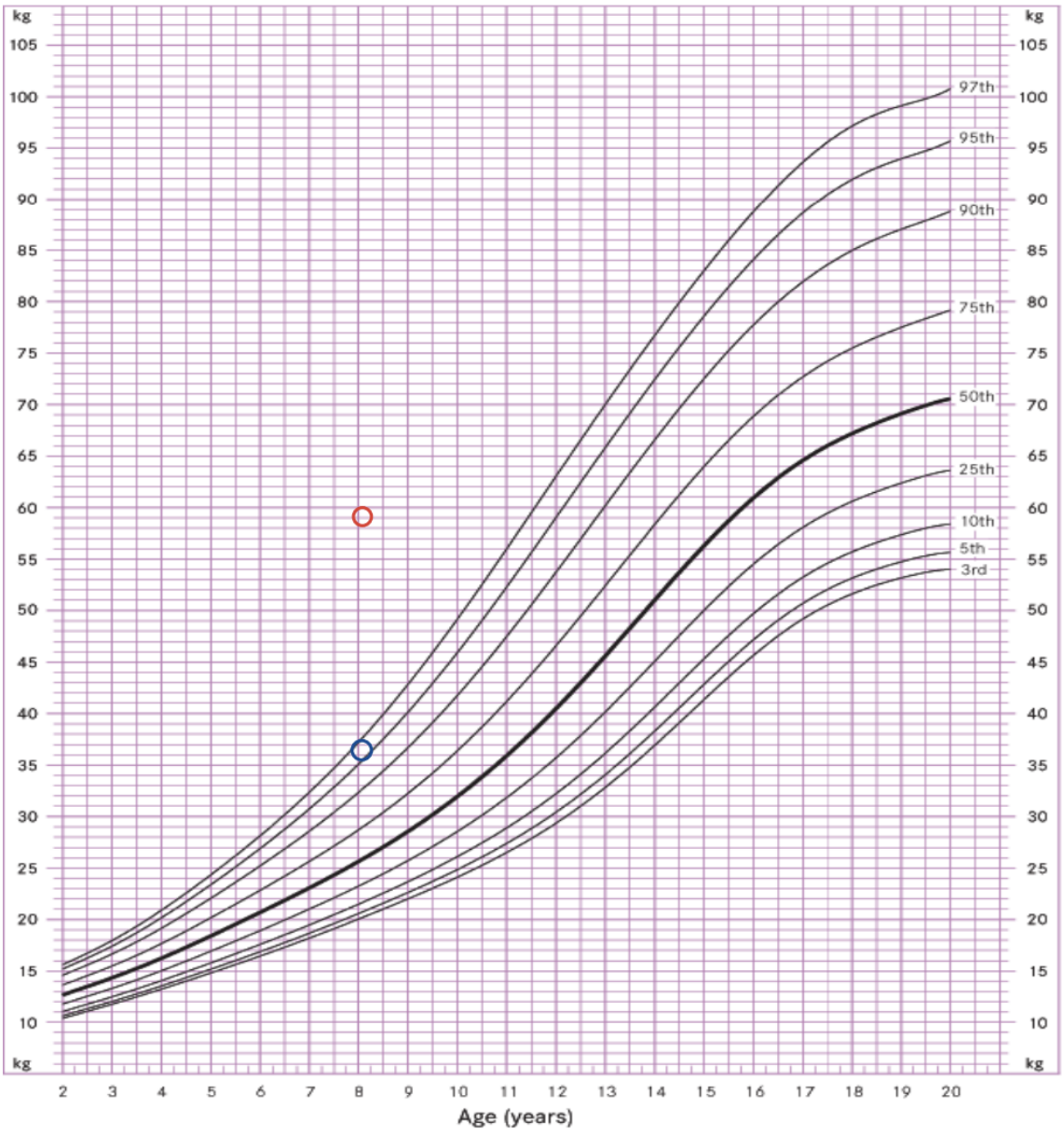
In this example an eight-year-old boy has a weight of 60 kg, and height of 138 cm which is on the 95th percentile for his age, thus his predicted weight for height is obtained by determining what weight corresponds to the 97th percentile for an eight-year-old boy, and here it is 35 kg. Therefore, his doses should be calculated using 35 kg, rather than 60 kg.

Actual weight and height = red Predicted weight for height = blue

Stature-for-age percentiles: Boys, 2 to 20 years



Weight-for-age percentiles: Boys, 2 to 20 years



Growth charts developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000). The charts are available at www.health.vic.gov.au/childhealthrecord/growth_details/boys.htm

More information available:
https://www.nps.org.au/assets/34d0e45ded6cdd84-7021bbcd103a-f340beb12ecb84ceffad919618a9fd8356b11b5a3566eb0eacf617de37ec.pdf