

Section 9: Paediatrics

Edited by Dr Ian Barker

- 9.1 Pre-operative parent and child information
- 9.2 Pre-operative fasting in elective paediatric surgery
- 9.3 Premedication in pre-school age children
- 9.4 Parent satisfaction with arrangements for being present with their child at induction
- 9.5 Peri-operative temperature control in children
- 9.6 Post-operative pain management
- 9.7 Peri-operative fluid audit in children
- 9.8 Paediatric sedation
- 9.9 Pain at home after day case surgery in children
- 9.10 Unplanned hospital admission following paediatric day case surgery
- 9.11 Care pathways for dental extractions under general anaesthesia in children
- 9.12 Post-operative vomiting in children

9.1

Pre-operative parent and child information

Dr O Bagshaw

Why do this audit?

Parents and their children demonstrate a high incidence of anxiety prior to surgery.^{1,2} High pre-operative anxiety levels in children have been shown to have an adverse effect on recovery.³ They may be concerned about premedication, the anaesthetic, procedures, possible complications and particularly post-operative pain.^{4,5} Adequate pre-operative information and preparation will help allay these concerns and reduce anxiety.⁶ Participation by parents in aspects of anaesthesia decision-making, such as induction and methods of post-operative analgesia, increases their satisfaction with the care their child receives.⁷ Older children can more readily identify their information needs, but often these are not met.^{5,8}

Best practice: research evidence or authoritative opinion

Pre-operative information in the form of leaflets, videotapes, educational programmes, or through telephone consultation or pre-admission clinics, has been shown to reduce anxiety, answer questions, raise issues for discussion and avoid unnecessary investigations and cancellations.^{4,9} There is also evidence that explaining the risks of anaesthesia gives parents a better understanding of what is involved, without actually raising anxiety levels or influencing their decision to proceed with the proposed surgery.⁶ Older children have been shown to want comprehensive information about their surgery.⁵

The Association of Paediatric Anaesthetists and the Royal College of Anaesthetists have produced information leaflets for children of different ages from four years upwards. These can be downloaded via the following link: <http://www.rcoa.ac.uk/childrensinfo>.

Suggested indicators

- D % parents who had access to pre-operative information.
- D % parents who were sent pre-operative information by post.
- D % parents who received pre-operative information.
- D % parents/children who found the information satisfactory.
- D % parents who attempted to contact the hospital for advice about the anaesthetic, and who were able to get the advice they sought.
- D % parents/children assessed and counselled by an anaesthetist pre-operatively on the ward and given an opportunity to ask questions.
- D % parents/children who rated the interview satisfactory.

Proposed standard or target for best practice

- D 90% of parents should receive postal pre-operative information.
- D For all other indicators, the value should be 100%.

Suggested data to be collected

- D Did the parent/child have access to or receive information pre-operatively?
- D Did it tell them what they wanted to know?
- D Did they attempt to contact the hospital for advice and if so, were they successful?
- D Did they see an anaesthetist pre-operatively?
- D Was appropriate information given?
- D Did they have an opportunity to ask questions and if so, were these answered satisfactorily?

These questions should be asked by an auditor who is independent of the anaesthetist.

You may wish to make a list of what you consider to be minimum elements of the pre-anaesthetic interview and ask which were included.

Cancellation or non-attendance should be scrutinised in the context of patient information. Was it related to lack of patient/child information in some way?

Common reasons for failure to meet standard

- D Lack of opportunity to access pre-operative information (no leaflets, no website, no pre-admission etc.)
- D Administrative failure in sending out pre-operative information.
- D No mechanism for dealing with telephone enquiries from parents.
- D Failure of parents/child to attend pre-admission clinic.
- D Failure of anaesthetist to visit patient pre-operatively.
- D Failure of anaesthetist to extract adequate information from the parent/child.
- D Parent not present when child assessed by anaesthetist.

Related audits

I.1 – Patient information about anaesthesia

CPD and Curriculum mapping

CPD matrix codes: **IF01, 2D02**

Training curriculum competences: **PA_BK_02, PA_BK_I7**

References

- 1 Thompson N et al. Preoperative parental anxiety. *Anaesthesia* 1996;**51**:1008–1012.
- 2 Wollin SR et al. Anxiety in children having elective surgery. *J Pediatr Nurs* 2004;**19**:128–132.
- 3 Kain ZN et al. Preoperative anxiety, postoperative pain, and behavioural recovery in young children undergoing surgery. *Pediatrics* 2006;**118**:651–658.
- 4 Wisselo TL et al. Providing parents with information before anaesthesia: what do they really want to know? *Pediatr Anesth* 2004;**14**:299–307.
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- 8 Smith L, Callery P. Children's accounts of their preoperative information needs. *J Clin Nurs* 2005;**14**:230–238.
- 9 Kain ZN et al. Parental desire for perioperative information and informed consent: a two-phase study. *Anesth Analg* 1997;**84**:299–306.



9.2 Pre-operative fasting in elective paediatric surgery

Dr T Dorman

Why do this audit?

Adequate pre-operative fasting reduces the risk of regurgitation of stomach contents at the time of induction of anaesthesia. This must be balanced against the risks of prolonged fasting leading to hypoglycaemia, dehydration and distress. There can be difficulties planning fasting times due to list changes, unpredictable operating time and patient or parent compliance.^{1,2}

Because of logistical problems on lists, e.g. cancellations, most fasting guidelines work on the start time of the list so children later on the list will starve longer especially if the list is delayed. It is difficult to fast children to an exact time on the list.

Best practice: research evidence or authoritative opinion

Major studies have shown that there is no increase in risk of aspiration if clear fluids are given up to and at 2 hours pre-operatively against a background of 6 hours fasting time for solids and milk (cow's and formula).^{3,4,5,6}

The following practice is suggested:

Children over the age of 6 months

- D Clear fluids should be given up to and at 2 hours before induction of anaesthesia.
- D Children should be fasted from solids, milk (any type including formula) for 6 hours before induction of anaesthesia. In order to prevent excessively long starvation, children on morning lists should be fed as late as possible the night before (but not after 02.30 for 08.30 start time). Children on an afternoon list should have a light breakfast at 07.30 for a start time of 13.30.

Neonates and babies under the age of 6 months

- D Breast milk up to and at 4 hours before the induction of anaesthesia.
- D Formula milk up to and at 6 hours before the induction of anaesthesia.
- D Clear fluids up to and at 2 hours before the induction of anaesthesia.

Suggested indicators

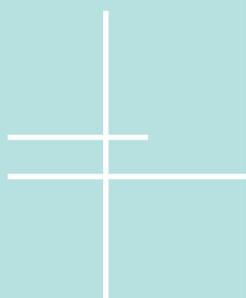
- D % children who fit the criteria above.
- D % of list changes or cancellations because children aren't starved appropriately.

Proposed standard or target for best practice

- D 100% of children for elective surgery should fit with the suggested practice.
- D 100% of parents/children should be given the correct instructions.

Suggested data to be collected

- D Number of patients/parents receiving correct instructions.
- D Compliance, i.e. number following instructions.
- D Last oral intake time and what it was.
- D Time of induction.
- D Factors affecting time of induction, e.g. delays.
- D Time to first intake.
- D Problems on induction, e.g. vomiting, regurgitation etc.
- D Problems post-operatively, e.g. PONV.



Common reasons for failure to meet standard

- D Patients/parents have not received correct instructions.
- D Non compliance with instructions e.g lack of understanding.
- D Logistical problems with lists: delays, cancellations etc.
- D Difficulty predicting the exact time of induction.

Related audits

I.7 – Pre-operative fasting in adults

CPD and Curriculum mapping

CPD matrix codes: **IA01 (physiology), 2D06**

Training curriculum competences: **PA_BK_03, PA_IK_03**

References

- 1 Philips S, Daborn AK, Hatch DJ. Pre-operative fasting for paediatric anaesthesia. *Br J Anaesth* 1994;**73**:529–536.
- 2 Veall G, Dorman T. Prolonged Starvation in Paediatrics. *Anaesthesia* 1995;**50**:458–460.
- 3 Schreiner MS, Triewasser A, Keon TP. Ingestion of liquids compared with pre-operative fasting in paediatric outpatients. *Anesthesiology* 1990;**72**:593–597.
- 4 Splinter WM, Stewart JA, Muir JG. Large volumes of apple juice pre-operatively do not affect gastric fluid pH and volume in children. *Can J Anaesth* 1990;**37**:36–39.
- 5 Splinter WM, Schaefer JD, Zunder IH. Clear fluids three hours before surgery does not affect the gastric fluid contents of children. *Can J Anaesth* 1990;**37**:498–501.
- 6 Practice guidelines for pre-operative fasting and the use of pharmacological agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures. An updated report by the American Society of Anaesthesiologists Committee on Standards and Practice Parameters. *Anesthesiology* 2011;**114**(3):495–511 (http://journals.lww.com/anesthesiology/Fulltext/2011/03000/Practice_Guidelines_for_Preoperative_Fasting_and_13.aspx).
- 7 Brady M et al. Pre-operative fasting for preventing pre-operative complications in children *Cochrane Database of Systematic Reviews*, 2009, Issue 4. No: CD005285 (<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005285.pub2/full>).



9.3

Premedication in pre-school age children

Dr C G Stack

Why do this audit?

Induction of anaesthesia may be a stressful experience for pre-school age children and their parents. If the child resists intervention, unnecessary distress may occur. As well as being undesirable in itself, this may also influence the child's attitude to medical care in the future.

Best practice: research evidence or authoritative opinion

Sedative premedication of pre-school age children reduces the frequency of crying and the need for restraint at induction of anaesthesia even when the child is accompanied by a parent and has a topical anaesthetic applied before intravenous induction.¹ Sedative premedication makes post hospital behavioural disturbances less likely even after day surgery.² Routine use is probably not justified because there is evidence that it is possible to predict which children are likely to cry.³ One well researched sedative premedicant for children is oral midazolam 0.5–0.75 mg/kg, administered 30–60 min before induction.² It can be used in day case anaesthesia. Other sedatives such as clonidine, 1–5 micrograms/kg, tend to act for longer post-operatively although there is the advantage of additional analgesic effects.⁴ There is evidence that clonidine (4 micrograms/kg) may be superior to midazolam (0.5mg/kg) in acceptance by the patient, better sedation effect, a higher degree of parental satisfaction and a trend to smoother emergence albeit with a slower, but probably not clinically, significant time to sedation.⁵

Suggested indicators

- D % of children age 1–5 years who do not cry or need restraint at induction.
- D % of children age 1–5 years for whom an IV induction is planned who have a topical anaesthetic applied at an appropriate time.

Proposed standard or target for best practice

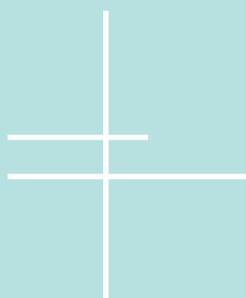
- D 75% children age 1–5 years should pass through the anaesthetic room without crying or needing restraint.¹
- D 100% children age 1–5 years should have a topical local anaesthetic applied at an appropriate time before a planned intravenous induction.

Suggested data to be collected

- D Anaesthetist – name and grade.
- D Age of patient.
- D Parent present, and if not why not.
- D Planned route of induction.
- D Application of a topical local anaesthetic and how long before induction.
- D Sedative premedication: drug, dose, route, and time relative to induction.
- D Assessment of child's response to IV insertion and induction.

Common reasons for failure to meet standard

- D Lack of nursing and medical staff with sufficient paediatric training and experience.
- D Failure of anaesthetist to judge the need for sedation.
- D List changes prevent the application of topical local anaesthetic.
- D Absence of parent or separation at the theatre door.



Related audits

I.8 – Premedication

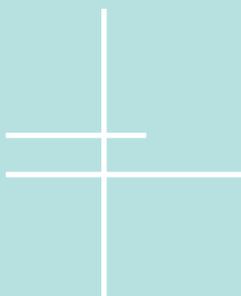
CPD and Curriculum mapping

CPD matrix codes: **2D02, 2D06**

Training curriculum competences: **PA_BK_12**

References

- 1 Page B, Morgan-Hughes JO. Behaviour of small children before induction. The effect of parental presence and EMLA and premedication with triclofos or a placebo. *Anaesthesia* 1990;**45**:821–872.
- 2 McCluskey A, Meakin GH. Oral administration of midazolam as a premedicant for paediatric day-case anaesthesia. *Anaesthesia* 1994;**49**:782–785.
- 3 Hannallah RS, Rosen DA, Rosen KR. Residents' ability to predict children's co-operation with anaesthesia induction. *Anesthesiology* 1985;**63**:502.
- 4 Bergendahl HT et al. Clonidine vs. midazolam as premedication in children undergoing adenotonsillectomy: a prospective, randomised, controlled trial. *Acta Anaesth Scand* 2004;**48**:1292–1300.
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9.4

Parent satisfaction with arrangements for being present with their child at induction

Dr J Payne

Why do this audit?

Parental presence at induction is routinely practised in most UK hospitals in line with RCoA recommendations that 'parents should be involved in care processes. Child-centred approach to anaesthesia and surgery should be employed with, as far as possible, provision for parents to accompany children both to the anaesthetic room and into the recovery area'.^{1,2} The Royal College of Surgeons of England similarly expect that 'parents will normally be given the chance to accompany their child in the anaesthetic room'.³

Best practice: research evidence or authoritative opinion

Contrary to popular belief, a recent evidence-based review of 14 studies suggested that only rarely did parental presence reduce child or parent anxiety.⁴ However, another study concluded that 'parents of children who undergo a subsequent surgery prefer to be present during the induction of anaesthesia regardless of the (anxiety-reduction) intervention that was used in the initial surgery'.⁵

Suggested indicators

D % of parents either satisfied or very satisfied with arrangements for being present with their child at induction.

Proposed standard or target for best practice

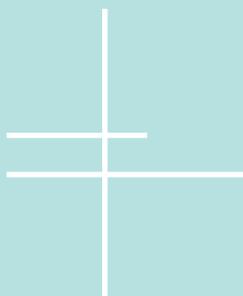
- D Comments from older children/teenagers on parental presence.
- D 100% of parents invited to be present with their child at induction should be satisfied with the arrangements made to do so.

Suggested data to be collected

- D Assessment of satisfaction level using post-operative questionnaire. You may wish to explore this in detail, e.g. satisfaction with pre-operative explanation, with waiting arrangements, with actual events in the anaesthetic room, with the support they received afterwards etc.
- D Reasons for dissatisfaction.

Common reasons for failure to meet standard

- D Parents feeling unprepared, e.g. unsure of role.
- D Parents who did not want to attend at induction feeling pressurised to do so.
- D Parents feeling unsupported in the anaesthetic room.
- D Parents not being on the ward when the child was collected for theatre, owing to list changes.



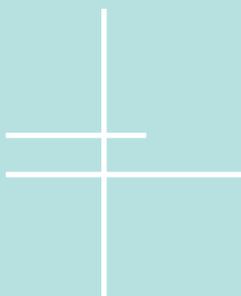
CPD and Curriculum mapping

CPD matrix codes: IF01, 2D02

Training curriculum competences: PA_BK_02, PA_BK_17

References

- 1 Guidelines for the provision of paediatric anaesthetic services. RCoA, London 2011 (<http://www.rcoa.ac.uk/node/714>).
- 2 Getting the right start. National Service Framework for Children: Standard for Hospital Services. DH, London 2003 (<http://www.dh.gov.uk/assetRoot/04/06/72/51/04067251.pdf>).
- 3 Surgery for children: delivering a first class service. RCSEng, London 2007 (<http://www.rcseng.ac.uk/publications/docs/CSF.html>).
- 4 Chundamala J, Wright JG, Kemp SM. An evidence-based review of parental presence during anesthesia induction and parent/child anxiety. *Can J Anaesth* 2009;**6**(1):57–70.
- 5 Kain ZN et al. Parental intervention choices for children undergoing repeated surgeries. *Anesth Analg* 2003;**96**(4):970–975.



9.5

Peri-operative temperature control in children

Dr C Kirton

Why do this audit?

Thermoregulation is known to be disrupted in the peri-operative period, with the paediatric population particularly at risk. The Association of Anaesthetists advises that body temperature monitoring must be available in paediatrics, and used when appropriate.¹ This audit will establish whether warming techniques are being used effectively in children and whether appropriate intra-operative monitoring is being used.

Best practice: research evidence or authoritative opinion

Hypothermia is in most cases deleterious,² being associated with increased oxygen consumption³ and shivering,⁴ with a decrease in platelet function⁵ and consequent blood loss,⁶ with the risk of surgical wound infection⁷ and with impairment of drug metabolism.⁴ Maintenance of normothermia is possible using a variety of warming devices. Inditherm mattresses and forced air blowers are particularly effective.⁴ The large surface area-mass ratio of infants allows rapid cooling and rewarming, and therefore monitoring is important.

Suggested indicators

D % children who arrive in the recovery area with tympanic (or axillary) temperature in the range 36–37°C.^{6,7}

Proposed standard or target for best practice

D 100% of children should meet the above criteria.

Suggested data to be collected

D Patient age and weight, operation, duration of anaesthesia, temperature monitoring used intra-operatively, warming methods used, tympanic or axillary temperature on arrival in recovery.

Common reasons for failure to meet standard

- D Non-availability of warming equipment or monitoring devices.
- D Failure to use equipment, perhaps due to lack of awareness of the importance of temperature control.
- D Unexpected lengthy duration of surgery.
- D Over zealous warming without monitoring.

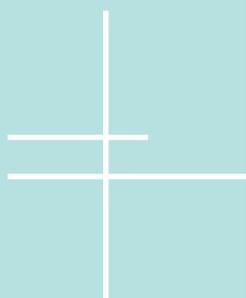
Related audits

2.7 – Peri-operative temperature management

CPD and Curriculum mapping

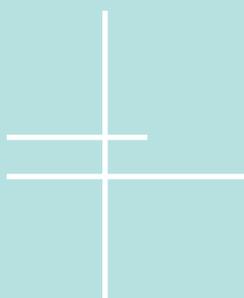
CPD matrix codes: IA01(physiology), 2D02

Training curriculum competences: PA_IK_06, PA_IS_05



References

- 1 Recommendations for standards of monitoring during anaesthesia and recovery. AAGBI, London 2007 (<http://www.aagbi.org/pdf/Absolute.pdf>).
- 2 Leslie K, Sessler DI. Perioperative hypothermia in the high-risk surgical patient (Review). Best practice and research. *Clin Anaesthesiol* 2003;**17**(4):485–498.
- 3 Adamsons K Jr, Gandy GM, James LS. The influence of thermal factors upon oxygen consumption of the new born infant. *J Pediatr* 1965;**66**:495–508.
- 4 Sessler DI. Perioperative thermoregulation and heat balance. *Ann NY Acad Sci* 1997;**813**:757–777.
- 5 Valeric R et al. Hypothermia-induced reversible platelet dysfunction. *Ann Surg* 1987;**205**:175–181.
- 6 Cheney FW. Should normothermia be maintained during major surgery? *J Am Med Assoc* 1997;**277**:1165–1166.
- 7 Kurz A, Sessler DI, Lenhardt R. Perioperative normothermia to reduce the incidence of surgical- wound infection and shorten hospitalization. *New Engl J Med* 1996;**334**:1209–1215.



9.6

Post-operative pain management

Dr J M Goddard

Why do this audit?

Pain is experienced by paediatric patients of all ages,¹ especially in the post-operative period. The evidence in paediatric practice that relief of post-operative pain is cost-effective or beneficial to organ function is lacking. Nonetheless pain relief is a basic humanitarian requirement, which in the hospital environment is entrusted to healthcare professionals.² It is essential that this responsibility is discharged safely and effectively.

Best practice: research evidence or authoritative opinion

The principles of treating acute pain in hospital are well established.³ Authoritative reports recommend that these principles are best achieved by the establishment of an Acute Pain Service (APS).⁴ The evidence base in paediatric practice for specific techniques has been endorsed by several organisations.⁵ Nonetheless, contextual factors – culture, relationships and organisational issues – need to be addressed. Data in paediatric practice confirm that it is the structure and process of an APS that most improves pain relief rather than specific analgesic techniques.⁶ The routine assessment and recording of pain is pivotal; evidence-based guidance should be utilised.^{5,7} A record of pain assessment should be developed to suit local circumstances; incorporation into routine hospital documentation is recommended.⁸ Inclusion of pain assessment in paediatric early warning system documentation should be sought.

Suggested indicators

- D % of days when paediatric ward is visited by the acute pain team.
- D % of children undergoing surgery who have a complete record of pain scores.
- D % of children with unacceptable pain scores in the post-operative period.
- D % of children managed as day cases assessed to be in severe pain at home.
- D Patient and parent experiences of pain management.

Proposed standard or target for best practice

The local APS needs to consider what their targets should be. In particular the method and frequency of pain scoring will be decided. It is recommended that pain is considered as the 5th vital sign and recorded alongside routine observations of temperature, pulse rate etc.

In-patients

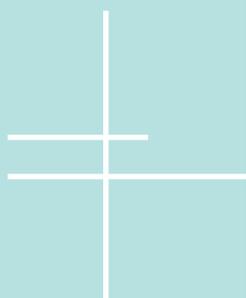
- D On 95% days, a member of the APS should visit all paediatric surgical wards.
- D 95% children undergoing surgery should have a complete record of pain scores.
- D < 5% children should have an unacceptable pain score at any time. The pain score deemed to be unacceptable needs to be chosen, and will depend on which validated pain assessment tool the team wishes to use.

Day cases

- D No child should be assessed as being in severe pain on discharge or at home.

Suggested data to be collected

- D Presence/absence of APS and its members.
- D Evidence of daily visit by APS member to paediatric surgical wards.
- D For each child undergoing surgery: completeness of pain score record.
- D Worst pain score each day in all post-operative children, reason and any action taken.
- D Qualitative data on patient and parent experiences of pain management.
- D Parental assessment of pain at home.



Common reasons for failure to meet standard

- D Holiday, sickness, other duties (of acute pain team).
- D No dedicated acute pain team or no weekend cover.
- D Pain scores not considered important, staff too busy, no organisational support for pain services.
- D Failure to supply appropriate analgesics for use at home.
- D Inadequate instructions for parents on analgesic administration.

Related audits

- 5.3 – Adequacy of post-operative pain relief after discharge
- 11.1 – Education and training by the acute pain team
- 11.4 – Assessment and documentation in acute pain management
- 11.5 – Efficacy of acute pain management in the post-operative period

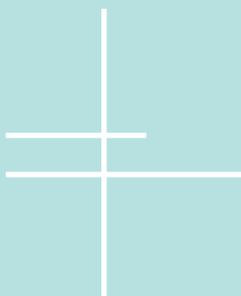
CPD and Curriculum mapping

CPD matrix codes: **ID01, ID02, 2D05**

Training curriculum competences: **PA_BK_07, PA_BK_11, PA_IK_09, PA_IS_07**

References

- 1 Schechter NL, Berde CB, Yaster M. Pain in infants, children, and adolescents, 2nd edn. *Lippincott Williams and Wilkins*, Philadelphia 2003.
- 2 Department of Health. Getting the right start: National service framework for children. Standard for hospital services. *DH*, London 2003.
- 3 McQuay H, Moore A, Justins D. Treating acute pain in hospital. *Br Med J* 1997;**314**:1531–1535.
- 4 Royal College of Surgeons of England and College of Anaesthetists. Report of the Working Party on Pain after Surgery. Commission on the provision of surgical services. *RCSEng*, London 1990.
- 5 Good practice in post-operative and procedural pain management. A guideline from the Association of Paediatric Anaesthetists of Great Britain and Ireland. *Pediatr Anesth* 2008;**18**(suppl 1):1–81.
- 6 Goddard JM, Pickup SE. Post-operative pain in children. Combining audit and a clinical nurse specialist to improve management. *Anaesthesia* 1996;**51**:588–591.
- 7 The recognition and assessment of acute pain in children. *RCN*, London 2009.
- 8 Standards for assessing, measuring and monitoring vital signs in infants, children and young people. *RCN*, London 2011.



9.7

Peri-operative fluid audit in children

Dr N Barker

Why do this audit?

Hyponatraemia (plasma sodium < 135 mmol/L) may result from the use of hypotonic fluids, especially during the peri-operative period when vasopressin levels may be elevated. This can result in hyponatraemic encephalopathy. Administration of glucose during surgery may lead to intra-operative hyperglycaemia which can cause an osmotic diuresis leading to dehydration and electrolyte disturbance; however children at risk of hypoglycaemia should be given dextrose containing fluids. The purpose of this audit is to observe the use of intravenous fluids given to children during the peri-operative period and therefore to check that current guidance is being followed.

Best practice: research evidence or authoritative opinion

There have been a number of concerns and case reports of morbidity associated with hyponatraemia due to water intoxication in the peri-operative period.^{1,2} The NPSA (National Patient Safety Agency) produced a safety alert to reduce the risk of hyponatraemia in children and the APA (Association of Paediatric Anaesthetists of Great Britain and Ireland) produced a consensus guideline on peri-operative fluid management in children.^{3,4}

Suggestions to help avoid hyponatraemia are to administer isotonic fluids for all replacement fluid and possibly for maintenance in the intra-operative period.

Hyperglycaemia is best avoided – as well as the osmotic diuresis issues, hyperglycaemia in combination with hypoxic cerebral or spinal cord insult will worsen neurological outcome. If dextrose is avoided, the majority of children over 1 month will maintain a normal blood sugar. However, hypoglycaemia is a very serious complication and certain conditions favour intra-operative glucose administration: e.g. those on parenteral nutrition or a dextrose containing solution prior to theatre, children of low body weight (< 3 rd centile) or having surgery of more than 3 hours and children having extensive regional anaesthesia.

Suggested indicators

- D Replacement (for deficit and ongoing losses) should be with an isotonic fluid such as Normal Saline, Hartmann's, colloid or blood where appropriate.
- D Hypotonic fluids should be reserved for maintenance use. (Many children will be prescribed isotonic fluids in the peri-operative period.)
- D During surgery, dextrose containing maintenance fluids should be given to children at risk of hypoglycaemia.
- D Monitor plasma glucose if glucose-free solutions are used during surgery where surgery is over 3 hours in duration.
- D Plasma electrolytes should be checked every 24 hrs and a fluid input/output chart used whilst intravenous fluids are being administered in the peri-operative period.

Proposed standard or target for best practice

- D 100% of children receiving intravenous fluids in the peri-operative period should meet the above criteria.

Suggested data to be collected

- D Date of birth.
- D Weight.
- D Procedure, duration of procedure.
- D Estimated blood loss.
- D Type and amount of fluid/blood administered intra-operatively.
- D Post-operative fluid prescription.
- D Whether electrolytes are monitored and fluid balance charts used in the peri-operative period.

Common reasons for failure to meet standard

- D A lack of awareness or dissemination of the recent guidance and safety alerts for the administration of intravenous infusions to children.
- D Inadequate training and supervision for all staff involved in the prescribing, administering and monitoring of intravenous infusions for children.

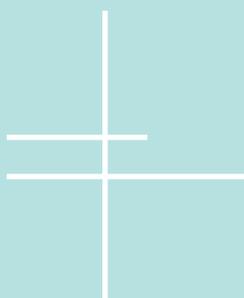
CPD and Curriculum mapping

CPD matrix code: **2D04**

Training curriculum competences: **PA_BK_09, PA_HS_05**

References

- 1 Halberthal M, Halperin ML, Bohn D. Lesson of the week: Acute Hyponatraemia in children admitted to hospital: retrospective analysis of factors contributing to its development and resolution. *Br Med J* 2001;**322**:780–782.
- 2 Arieff AL. Postoperative hyponatraemic encephalopathy following elective surgery in children. *Paediatr Anaesth* 1998;**8**:1–4.
- 3 Reducing the risk of hyponatraemia when administering intravenous infusions to children. *NPSA*, March 2007 (<http://www.nrls.npsa.nhs.uk/resources/?entryid45=59809&q=0%C2%AChyponatraemia%C2%AC>).
- 4 APA Consensus Guideline on Perioperative Fluid Management in Children v1.1. *APAGBI*, London September 2007 (http://www.apagbi.org.uk/sites/apagbi.org.uk/files/Perioperative_Fluid_Management_2007.pdf).



9.8

Paediatric sedation

Dr M Sury, Dr B Lattuca, Dr K Richardson

Why do this audit?

Sedation of children can lead to unintended loss of consciousness. In contrast some sedation techniques may not be effective enough and can lead to patient distress and failure to complete the procedure. Practitioners need to know how to deliver effective sedation and be able to manage the complications of airway obstruction, and cardio-respiratory depression.

Sedation, is usually administered by non-anaesthetists who may not have sufficient training. Ideally, all practitioners of sedation should be trained to deliver effective, procedure specific techniques, and to both prevent and manage the complications.

There are four common different types of procedures: dentistry, painful procedures in the emergency department, gastrointestinal endoscopy and painless imaging.

The hospital or healthcare facility in which sedation is carried out should be properly equipped and staffed. A Sedation Safety Committee or senior clinician should be appointed to oversee and ensure safe and effective practice.

Best practice: research evidence or authoritative opinion

Two recent guidelines have shaped opinion and practice.

- D The SIGN Guideline¹ was useful to advise on safe conscious sedation but did not advise on techniques that caused deep sedation or risked anaesthesia.
- D The NICE Guideline² considered wider practice and advised on the general sedation management of the 'Patient Journey' of children having diagnostic and therapeutic procedures and then also recommended drug techniques that were effective. The principles of training for practitioners using these techniques were recommended.

Suggested indicators

From NICE Guideline 112

- D The existence and adequacy of pre-sedation assessment including a readiness to seek specialist advice.
- D The suitability of sedation for the proposed patients.
- D The appropriateness of the chosen sedation technique.
- D The theoretical and practical training of the person delivering the sedation.
- D The training of sedation personnel in relevant resuscitation techniques.
- D The presence and adequacy of:
 - ◆ Sedation equipment
 - ◆ Resuscitation equipment
 - ◆ Monitoring equipment
 - ◆ Appropriate drugs.
- D The presence of the person delivering sedation and a trained assistant throughout the procedure.
- D Adequate documentation including
 - ◆ Patient/carer information
 - ◆ Consent information
 - ◆ Contemporaneous documentation of the sedation and physiological recordings
 - ◆ The success or otherwise of the sedation including complications, highlighting airway intervention.
- D Suggested (NICE 112) resuscitation training:

	Minimal sedation ^a	Moderate sedation	Deep sedation
All members	Basic	Basic	Basic
At least one member		Intermediate	Advanced

^aincluding sedation with nitrous oxide alone (in oxygen) and conscious sedation in dentistry.

Proposed standard or target for best practice

The target for best outcome should be 100% success with high satisfaction scores for patient, parents and practitioners. There should be no complications. The need for airway intervention depends upon the sedation technique used. Ideally there should be no need for any airway intervention.

The target for best practice should be 100% adherence to the recommendations.

Suggested data to be collected

The outcome, interventions and complications should be recorded.

Outcomes

Primary

- ▷ Successful completion of diagnostic or therapeutic procedure.

Secondary

- ▷ Behavioural ratings including pain, distress and anxiety.
- ▷ Patient or parent satisfaction.
- ▷ Sedation timing including duration of induction, the procedure, and the recovery.

Complications and interventions

- ▷ Vomiting.
- ▷ Oxygen desaturation.
- ▷ Aspiration.
- ▷ Respiratory intervention, including oral-pharyngeal airway, tracheal intubation, assisted ventilation.
- ▷ Cardiac arrest requiring external cardiac massage or defibrillation.

Common reasons for failure to meet standard

Sedation is

- ▷ generally undertaken by non-anaesthetists who may be concentrating on the procedure rather than the sedation
- ▷ undertaken sporadically and in small numbers
- ▷ carried out by a wide range of personnel and in many settings
- ▷ not perceived as a major safety problem by non-anaesthetists
- ▷ carried out by trainees
- ▷ not carried out using a protocol or agreed standards.

CPD and Curriculum mapping

CPD matrix codes: **2D06, 1A02 (pharmacology)**

Training curriculum competence: **PA_AS_03**

References

- 1 SIGN. Safe sedation of children undergoing diagnostic and therapeutic procedures. A national clinical guideline. Scottish Intercollegiate Guidelines Network. *SIGN*, Edinburgh 2004 (<http://www.sign.ac.uk/guidelines/fulltext/58/index.html>: "SIGN 58: Safe sedation of children undergoing diagnostic and therapeutic procedures has been withdrawn as new evidence has emerged that means the guideline no longer represents best practice. SIGN does not have any plans to produce a new guideline on this topic at present.")
- 2 Sedation for diagnostic and therapeutic procedures in children and young people. NICE Clinical Guideline CG112. *NICE*, London December 2010 (<http://www.nice.org.uk/guidance/CG112>).

9.9

Pain at home after day case surgery in children

Dr G Bell

Why do this audit?

With an increasing amount of surgery joining the list of 'suitable for day case' procedures it is incumbent on anaesthetists charged with the administration of peri-operative pain control to look further than the day surgery discharge lounge when assessing success of their post-operative analgesia regime, especially as their local anaesthetic blocks may wear off through the first post-operative night and outwith direct medical/nursing supervision.

Best practice: research evidence or authoritative opinion

It is well established that the expansion of day surgery has not been mirrored by a corresponding increase in the provision of analgesia at home following surgery.¹

It doesn't seem to be a lack of appropriate guidelines that underlines this problem, but a lack of application of such guidelines.²

Suggested indicators

- D Sleep pattern:
 - ◆ % disturbed
 - ◆ % normal on days 1–3 post-op.
- D Behaviour/mood:
 - ◆ % normal
 - ◆ % upset.
- D Activities:
 - ◆ % normal play resumed
 - ◆ % slight restriction
 - ◆ % considerable self-restriction.
- D Parental perception of child's discomfort:
 - ◆ % mild
 - ◆ % moderate
 - ◆ % severe.
- D % requirement to seek additional healthcare advice/medication, e.g. GP consultation

Proposed standard or target for best practice

- D 100% normal sleep pattern by 3rd post-op night.
- D 100% normal mood by day 3.
- D 100% normal activities by day 3.
- D 0% severe pain – any day
 - ◆ 90% mild or nil by day 2
 - ◆ 100% mild or nil by day 3 (this will be recorded as parental impression of child's pain)
- D 90% not requiring to seek additional healthcare advice for pain.

Suggested data to be collected

- D Age of patient.
- D Surgical procedure.
- D Analgesia dispensed by hospital.
- D Compliance with suggested analgesic regime – and reasons for non-compliance.
- D Precipitating factors for high pain scores.
- D Reasons for seeking additional healthcare advice.

Common reasons for failure to meet standard

- D Extensive or known painful surgery without specific protocols including moderate strength analgesia.
 - Dispensing issues prior to discharge.
- D Unavailability of medication at home.
- D Lack of appropriate written advice from hospital (specifically in an appropriate language – do not exclude non-English=1st language patient families from this audit).

Related audits

11.2 – Patient Information on pain management
11.5 – Efficacy of acute pain management in the post-operative period
11.8 – Patient satisfaction with pain management

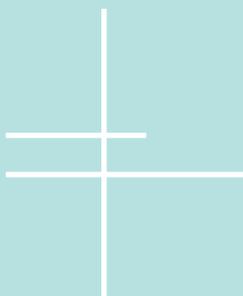
CPD and Curriculum mapping

CPD matrix codes: ID01, ID02, 2D05

Training curriculum competences: PA_BK_07, PA_BK_11, PA_IS_07, DS_BK_05

References

- 1 Wolf AR. Tears at bedtime: a pitfall of extending paediatric day-case surgery without extending analgesia. *Br J Anaesth* 1999;**82**:319–320.
- 2 Fortier MA et al. Paediatric pain after ambulatory surgery: where's the medication? *Paediatrics* 2009;**124**(4):588–595.



9.10

Unplanned hospital admission following paediatric day case surgery

Dr L Brennan

Why do this audit?

Unplanned overnight admission to hospital is stressful and a major inconvenience for children and their families. For healthcare providers it has adverse organisational and financial consequences. Unplanned admission increases the pressures on acute beds and hospitals are obliged to absorb the increased costs of in-patient care. High unplanned admission rates may be due to inadequacies in one or more aspects of the care pathway; patient selection, pre-assessment, peri-operative management, staff experience, as well as the day care facilities, geographical factors and case mix.¹

The Royal College of Anaesthetists and the Royal College of Surgeons of England have recognised unplanned admission rates as an important quality indicator of children's day case surgery in recent reports.^{2,3}

Best practice: research evidence or authoritative opinion

An unplanned admission rate of < 2% from day surgery units with a mixed adult and paediatric practice is suggested as an appropriate benchmark in audit 5.6 (see related audits). Several UK paediatric-only studies have been subsequently published with unplanned rates of 0.5% from a DGH unit and 1.8% from a tertiary children's hospital.^{1,4}

Suggested indicators

- D % children requiring unplanned overnight admission with reasons for this.
- D Existence of patient and procedure selection protocols for paediatric day surgery.
- D Existence of protocols for analgesia and management of emetic symptoms.

Proposed standard or target for best practice

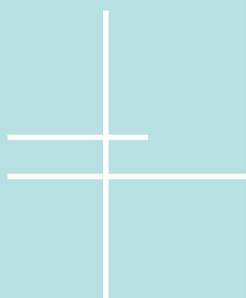
- D 100% of units managing children to have selection criteria and post-operative symptom protocols in place.
- D < 2% unplanned admission rate.

Suggested data to be collected

- D Patient demographics (age, specialty, procedure).
- D Grade of surgeon and anaesthetist.
- D Time of completion of procedure.
- D Reasons for admission:
 - ◆ nausea/vomiting
 - ◆ pain
 - ◆ drowsiness
 - ◆ unexpected surgical extent/difficulty
 - ◆ post-operative surgical complication
 - ◆ anaesthetic complication
 - ◆ inappropriate patient selection
 - ◆ other.

Common reasons for failure to meet standard

- D Medical and nursing staff unskilled in paediatric practice.
- D Lack of dedicated day case unit and staff.
- D No protocols or protocols not applied.
- D Inappropriate anaesthetic techniques.
- D Readmission to hospital following paediatric day surgery (within 48 hours).



Related audits

5.6 – Unplanned post-operative hospital admission after day surgery

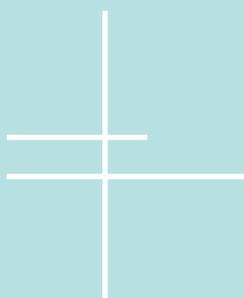
CPD and Curriculum mapping

CPD matrix codes: **2D02, 2D05**

Training curriculum competences: **DS_BK_06**

References

- 1 Blacoe DA, Cuning E, Bell G. Paediatric day-case surgery: an audit of unplanned hospital admission Royal Hospital for Sick Children Glasgow. *Anaesthesia* 2008;**63**:610–615.
- 2 Guidance on the provision of paediatric anaesthesia services. *RCoA*, London 2009 (<http://www.rcoa.ac.uk/node/714>).
- 3 Surgery for Children: Delivering a First Class Service. *RCSeng*, London 2007 (<http://www.rcseng.ac.uk/publications/docs/CSF.html>).
- 4 Rees S, Stocker M, Montgomery J. Paediatric outcomes in a DGH day surgery unit. *J One-Day Surg* 2009;**19**(4):92–95.



9.11

Care pathways for dental extractions under general anaesthesia in children

Dr L Adewale

Why do this audit?

In the UK each year over 60,000 children undergo general anaesthesia for dental extractions. Although the facilities and organisation of paediatric dental services vary widely, these children should receive the same standard of care as children undergoing general anaesthesia for any other procedure.

Best practice: research evidence or authoritative opinion

Prior assessment has been shown to improve the patient pathway on the day of the dental extractions. The importance of providing adequate information, with time for this to be considered by both the parent/carer and the child (if appropriate) has also been demonstrated.^{1,2,3}

Children should have access to pre-operative preparation by registered children's nurses and/or play therapists.⁴

Standards for intra-operative monitoring have been outlined by the AAGBI and should be employed regardless of the duration, location or mode of general anaesthesia for dental extractions.⁵

Unless contraindicated, non-steroidal anti-inflammatory drugs and/or paracetamol should be used to provide analgesia for dental extractions under general anaesthesia.⁶

Suggested indicators

- D % children attending for pre-operative assessment and preparation.
- D % parents/carers receiving pre-operative information before the day of the procedure.
- D % children offered pre-operative preparation by registered children's nurses and/or play therapists.
- D % cases in which intra-operative monitoring complies with standards outlined by AAGBI.
- D % children treated with peri-operative paracetamol and/or NSAIDs.

Proposed standard or target for best practice

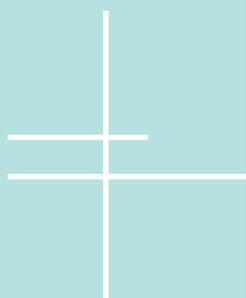
- D All indicators should be true in 100% of patients.

Suggested data to be collected

- D As for each indicator.

Common reasons for failure to meet standard

- D Social or geographical limitations may prevent some patients from attending for a separate pre-operative assessment appointment.
- D Distribution of pre-operative information may be determined by administrative factors.
- D Inadequate pre-operative parent and patient information



CPD and Curriculum mapping

CPD matrix code: **2D02**

Training curriculum competence: **EN_IK_10**

References

- 1 Information for children and young people. *RCoA*, London 2010 (<http://www.rcoa.ac.uk/childrensinfo>).
- 2 Your child's general anaesthetic for dental treatment. *RCoA*, London 2008 (<http://www.rcoa.ac.uk/node/1855>).
- 3 Spencer C, Franck LS. Giving parents written information about children's anaesthesia: Are setting and timing important? *Pediatr Anesth* 2005;**15**:547–553.
- 4 Short J, Malik D. Preoperative assessment and preparation for anaesthesia in children. *Anaesthesia and Intensive Care Medicine* 2009;**10**:489–494
- 5 Recommendations for Standards of Monitoring during Anaesthesia and Recovery (4th Edition). *AAGBI*, London 2007 (<http://www.aagbi.org/sites/default/files/standardsofmonitoring07.pdf>).
- 6 Good practice in postoperative and procedural pain (2nd edition – in press). *APAGBI*, London 2012.

9.12

Post-operative vomiting in children

Dr A Carr, Dr G K Simpson

Why do this audit?

Post-operative vomiting (POV) is approximately twice as frequent in children compared with adults with an incidence of 13–42% in all paediatric patients.^{1,2} It is one of the major causes of parental dissatisfaction after surgery and is the major cause of unanticipated hospital admission after day surgery with resulting increased healthcare costs.^{3,4} Severe POV can result in a range of complications including dehydration, electrolyte imbalance, wound dehiscence and pulmonary aspiration.⁵

Identifying children at high risk of POV is beneficial so prophylactic anti-emetic therapy can be appropriately targeted. In addition, avoiding the indiscriminate use of prophylaxis prevents unnecessary financial costs and reduces risk of adverse drug reactions.⁶

Best practice: research evidence or authoritative opinion

The Association of Paediatric Anaesthetists of Great Britain and Ireland (APAGBI) has produced evidence-based guidelines on the prevention of POV in children⁷ using SIGN methodology.⁸

Risk factors

The main risk factors for POV in children are summarised as:

Patient factors

- D Age > 3 – Risk of POV continues to rise throughout early childhood and into adolescence. (Grade of evidence B)
- D Previous history of POV (B)
- D History of motion sickness (C)
- D Post-pubertal females (D)

Surgical factors

- D Operative procedures under general anaesthesia > 30 minutes (C)
- D Strabismus surgery (A)
- D Tonsillectomy +/- adenoidectomy (A)

Anaesthetic factors

- D Volatile agents – especially in children with other risk factors (A)
- D Opioids – particularly long acting agents in the post-operative period (B)
- D Anticholinesterase drugs (D)
- D Nitrous oxide does not appear to be associated with a high risk of POV in children (C)
- D Peri-operative fluids may reduce POV in children (B)

Recommendations for prevention of POV in children**Children at INCREASED risk of POV**

- D IV ondansetron 0.15mg/kg prophylactically (A)

Children at HIGH risk of POV

- D (Adenotonsillectomy or strabismus surgery) (A)
- D IV ondansetron 0.1–0.15 mg/kg
- D IV dexamethasone 0.15 mg/kg
- D Consider intravenous anaesthesia and alternatives to opioid analgesia in children at high risk of POV. (D)

Recommendations for treatment of established POV in children

- D IV ondansetron 0.15mg/kg – if not already given ondansetron prophylactically. (B)
- D Children who have already been given ondansetron should be given a second anti-emetic from another class, such as IV dexamethasone 0.15mg/kg injected slowly.
- D Overall there is no evidence to support the use of metoclopramide (A), cyclizine (A) or prochlorperazine (D) in children.

Suggested indicators	<ul style="list-style-type: none"> D Children with a documented risk assessment for POV. D Children receiving prophylactic anti-emetics as per APAGBI guidelines: <ul style="list-style-type: none"> ◆ Ondansetron for children at increased risk of POV ◆ Ondansetron & Dexamethasone for children at high risk of POV i.e. those undergoing tonsillectomy ± adenoidectomy or squint surgery. D Children with established PONV treated as per APAGBI guidelines: <ul style="list-style-type: none"> ◆ Ondansetron for children who have not already received prophylactic ondansetron ◆ Dexamethasone for children who have already received prophylactic ondansetron. D Children admitted to hospital due to POV D Children receiving opioid sparing analgesia where appropriate (e.g local/regional anaesthesia, NSAID, paracetamol).
Proposed standard or target for best practice	<ul style="list-style-type: none"> D 100% of children should have a risk assessment for POV. D 100% children should receive prophylactic anti-emetics that follow APAGBI guidelines. D 100% of children with established PONV should be treated as per APAGBI guidelines. D 100% of children should receive balanced analgesia with appropriate consideration of opioid sparing techniques. D 0% children should be admitted to hospital after day-case surgery due to POV
Suggested data to be collected	<ul style="list-style-type: none"> D Evidence of risk assessment for POV. D Knowledge of all of the elements of the APAGBI guidelines. D Incidence and review of unplanned admissions for POV. D Anti-emetic usage for prevention and treatment of POV in children (drugs used and doses administered). D Use of appropriate opioid sparing analgesic techniques.
Common reasons for failure to meet standard	<ul style="list-style-type: none"> D Unawareness, or a lack of dissemination and implementation, of APAGBI evidence based recommendations. D Failure to perform a risk assessment for POV. D Under-recognition of POV and failure to follow up. D Delays in treatments due to staff levels. D Underuse of opioid sparing techniques such as local or regional anaesthesia. D Overuse of long acting opioids, particularly in the absence of prophylactic anti-emetics. D Poor documentation.
Related audits	3.5 – Post-operative nausea and vomiting
CPD and Curriculum mapping	CPD matrix code: 2D02 Training curriculum competence: PA_BK_07
References	<ol style="list-style-type: none"> 1 Lerman J. Surgical and patient factors involved in postoperative nausea & vomiting. <i>Br J Anaesth</i> 1992;69(suppl 1):24S–32S. 2 Rose JB, Watcha MF. Postoperative nausea and vomiting in paediatric patients. <i>Br J Anaesth</i> 1999;83(1):104–117. 3 D’Errico C et al. Prolonged recovery stay and unplanned admission of the paediatric surgical outpatient: an observational study. <i>J Clin Anesth</i> 1998;10:482–487. 4 Patel RI, Hannallah RS. Anesthetic complications following pediatric ambulatory surgery. <i>Anesthesiology</i> 1988;69:1009–1012. 5 Olutoye O, Watcha MF. Management of postoperative vomiting in paediatric patients. <i>Int Anaesthesiol Clinics</i> 2003;41(4):99–117. 6 Scuderi PE et al. Anti-emetic prophylaxis does not improve outcomes after outpatient surgery when compared to symptomatic relief. <i>Anesthesiology</i> 1999;90(2):360–371. 7 Guidelines on the prevention of post-operative vomiting in children. APAGBI, London 2009 (http://www.apagbi.org.uk/sites/apagbi.org.uk/files/APA_Guidelines_on_the_Prevention_of_Postoperative_Vomiting_in_Children.pdf). 8 Scottish Intercollegiate Guidelines Network (http://www.sign.ac.uk/methodology/index.html accessed September 2011)