

Paediatric day-case surgery

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Abstract

Paediatric day surgery is common and increasingly more complex surgeries are being carried out on more complex children. The benefits to the child and parent include less disruption to daily routines and fewer psychological and emotional effects than an overnight stay would incur. The use of day-case services improves efficiency and is more cost effective for organizations. To deliver high-quality paediatric day surgery services there are several key components to address. This article discusses the role of preoperative assessment and the need to consider each case individually despite robust inclusion/exclusion criteria. Optimization of preoperative hydration, pain management and prevention of postoperative nausea and vomiting are highlighted as important factors to successful day-case surgery.

Keywords Ambulatory surgery; day-case surgery; paediatric anaesthesia; paediatric pain management; paediatric sedation; pre-operative starvation

Royal College of Anaesthetists CPD Matrix: 3A06; 2D02, 2D05, 2D06

Introduction

A unifying definition of day-case surgery remains elusive. In the UK, a day case is when a planned patient is admitted and later discharged home without staying overnight.¹ This differs in other countries, notably in the USA where a stay of under 23 hours is deemed day case.

The momentum for increasing day surgery provision is due to advances in both surgical and anaesthetic techniques, patient and public expectations and the cost-efficiency benefits. The most recent data from 2013 shows that 78% of elective surgeries are day cases (surpassing the 75% target set by the NHS plan in 2000) and has potentially saved the NHS over £2bn allowing treatment of up to 1.3 million more patients.^{1,2}

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Learning objectives

After reading this article, you should:

- be aware of the inclusion and exclusion criteria for paediatric day surgery
- have strategies for minimizing postoperative pain in the hospital and at home
- have strategies for minimizing postoperative nausea and vomiting

Paediatric day-case services are particularly popular as many of the common surgical operations are especially well suited to this. Children are usually healthy with little comorbidity and the psychosocial benefits to the child and their family avoiding a prolonged hospital stay are well documented. Hence there is an increasing ambition to provide ambulatory care for children of younger ages and more complex medical conditions safely.

Facilities and organization

The most recent published standards by the children's surgical forum ensure the safeguarding of children undergoing ambulatory surgery (see Further reading and References). The main purpose of these standards is to ensure that children receive the very best care possible in the safest, most appropriate environment.

Ideally children should be treated in specifically designed paediatric day-case units where specialized equipment and paediatric-trained multidisciplinary teams are available from admission until discharge. There should be play specialists, translators and play areas to further improve experiences.

In non-specialist hospitals, children are cared for in predominantly adult environments but the standards should remain the same. All children should have a named consultant surgeon, anaesthetist and paediatrician involved/available during their stay. Consultants with paediatric lists and maintained core competencies should deliver anaesthesia. Registered paediatric nurses should be involved in the care of children and all staff should have child protection training with at least one of the team delivering care being up-to-date with paediatric resuscitation.

Providing day surgery in hospitals with no medical paediatric cover requires the presence of paediatric trained consultant surgeons and anaesthetists and a working agreement with neighbouring children's services to provide support and safe transportation for any complications. The overarching principle of these standards is to ensure that children receive surgery in a safe, appropriate environment, which is as close to their home as possible as stated by the European Charter of Children's rights.³

Advantages and disadvantages

The advantages outweigh the disadvantages for most children and families. Day-case care reduces the risk of nosocomial infections, anxiety behaviours such as nocturnal enuresis or disrupted sleep patterns and ensures that children have less time off

from school. For families, there is less disruption to work patterns and childcare needs: decreasing the economic load on society. Each day-case procedure confers not only considerable monetary savings but also delivers a far more efficient service.²

A friendly environment and approachable staff ensure families and patients feel well cared for and are not being rushed or discharged home under pressure. Patient/parent satisfaction with day-case care is usually high, but the services can be further optimized by shorter waiting times prior to surgery, good post-operative analgesia and next day follow-up maintaining contact, shifting the emphasis for facilitating delivery of postoperative care to the home setting.⁴

The major disadvantage is the inevitable inability to control factors once patients have been discharged, most notably pain, nausea and vomiting and deterioration of specific conditions. The feeling of abandonment once home by parents required to step into an unfamiliar medical/nursing role can be allayed by 24 hour telephone accessibility and also by provision of both robust verbal and written postoperative information and instructions.

Inclusion and exclusion criteria

In specialist environments ever more complex surgeries and patients are undergoing day-case procedures and the absolute exclusions to day-case anaesthesia are diminishing (Box 1). If children live a long way from the hospital, a patient hotel allows discharge of the otherwise well child from an inpatient bed negating a long homeward commute and maintaining access to suitable postoperative assistance.

Specialized cases need to be evaluated on their own merits and these include neonates, complex chronic conditions and the obese child.

Neonates

More premature babies are being considered for surgical procedures due to improved neonatal survival. There is little

evidence to suggest a specific age when neonates are suitable candidates for day surgery.^{5,6} The general consensus is that term babies are appropriate candidates for day surgery once they reach 44 weeks post conception age (PCA) but each neonate has to be considered individually, as well as taking into account the facilities and expertise on hand.

A special subgroup of neonates is the ex-premature infants. This group is at high risk of developing apnoea after anaesthesia regardless of whether a regional or general anaesthetic is used.⁷ Regional anaesthesia seems to decrease the risk of apnoeas in the first 12 hours postoperatively but not in the longer term (24 hours) period, which is critical for day-case surgeries.⁸ Risk factors for apnoea includes degree of prematurity at birth, PCA at time of surgery, previous postoperative apnoea and anaemia. Most centres limit day-case surgery until 60 weeks PCA (some consider anaesthesia at 50 weeks PCA). Figure 1 demonstrates the decision process required with neonates for day surgery.

Chronic conditions

Previously excluded complex chronic conditions are now being considered provided they are in a stable state. Parents are often experts in managing their child’s requirements such as home ventilation or feeding regimes and a prolonged stay in hospital may not improve upon this care. Increasingly complex cardiac repairs present for surgery and by using experienced anaesthetists and surgeons who understand the physiology and requirement of adequate preoperative hydration, even day surgery in children with Fontan circulations have been successful.

Inclusion categories for day-case surgery

Non-medical considerations

- Consent – agreement to day surgery by patient or/and parents
- Care – parents are able to accompany/look after the child on discharge
- Communication – parents are able to access 24 hours help from the hospital via a phone
- Closeness – patients reside within an hour of the hospital

Medical factors

- Healthy child/mild systemic disease or stable chronic disease
- Surgery included on the BADS directory of day-case procedures
- No excessive cardiovascular effects or blood loss
- No excessive postoperative pain anticipated

Specific considerations should be in place for age (post conception) and obesity and all children should have had good preoperative assessments carried out

Box 1

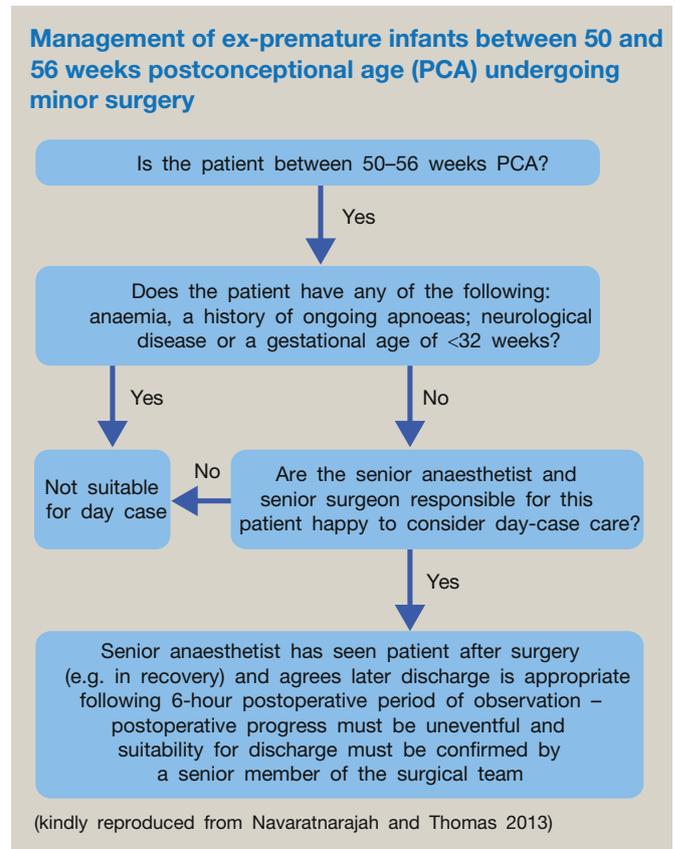


Figure 1

Obesity

Obesity is increasing amongst children. Undiagnosed issues such as obstructive sleep apnoea, asthma, type 2 diabetes, hypertension and gastro-oesophageal reflux can pose potential problems to the unsuspecting anaesthetist. The NHS modernization agency has raised the upper limits of BMI for day surgery to between 35 and 40 kg/m² despite the Association of Anaesthetists of Great Britain and Ireland maintaining that BMI should not be used as the only indicator for day-case suitability.³ In most centres an obese child is referred to the preadmission clinic for assessment and full exploration of co-morbidities (both known or potential).

Preoperative preparation

Nurse-led preoperative assessment services with consultant support is becoming commonplace and is important in preventing unnecessary day of admission cancellations. Screening questionnaires are completed online or via telephone. This process identifies patients who are suitable for day surgery and those that could be after undergoing further optimization. If preoperative assessment takes place at the hospital then ideally it should occur in the unit the child will attend allowing an informal visit of the facilities.

Mandatory preoperative investigations for apparently healthy children are rare. Since the introduction of routine sickle cell testing in the neonatal blood spot testing (for high-risk babies since 2006) even this is not carried out routinely preoperatively.

Information should be provided at the preadmission stage where there is less time pressure than at admission, allowing a more relaxed discussion of the procedure and its associated risks. All verbal information should be reinforced in writing so that the parents and or child can refer back to it at a later date. Well-informed individuals are more likely to be compliant, engage and be satisfied with the process. Some centres encourage the use of online material such as videos to try and allay anxieties and enhance patient and family experiences of the service.

Preoperative starvation and intraoperative fluids

Day surgery procedures have rapid turnovers and a quick recovery period is required. Children who are adequately hydrated are generally more cooperative and comfortable. The Association of Anaesthetists Great Britain and Ireland (AAGBI) states that recommended fasting times are:

- 6 hours for food
- 4 hours for breast milk
- 2 hours for clear fluids.⁹

However, the current evidence base challenges the traditional fasting for clear fluids and in keeping with this the APAGBI, ESPA and ADRPEF issued a consensus statement that 'unless there is a clear contra-indication, it is safe and recommended for all children able to take clear fluids, to allowed and encourage to have them up to 1 hour before elective general anaesthesia'.¹⁰

Most hospitals give generic times for starvation but operating lists do not always run to time or schedule, often leading to inadvertently longer fasting than necessary. Some centres successfully use staggered admissions allowing a more individualized starvation plan. With a fasting time of 1 hour for clear fluids, the majority of patients can be safely offered a drink on their

arrival at hospital without concern about delaying their journey to theatre. Empowering nurses to alert anaesthetists about prolonged starvation and offering an interim drink may improve hydration times, as can the inclusion of a 'hydration prompt' when discussing the theatre list at the team brief.

Minimal fasting times ensure a hydrated child and enable some short day-case surgeries to proceed without intraoperative intravenous fluid replacement. Replacement of fluid deficits intraoperatively is required if there is prolonged preoperative fasting or a lengthy operation time.

Anaesthesia

The top priorities in ambulatory anaesthesia are to deal with the four As (alertness, ambulation, analgesia and alimentation), otherwise the resulting failure can lead to the unwanted A of admission (unplanned).

Premedication

Using topical local anaesthetics prior to arrival in the anaesthetic room gives the best conditions for a placing an intravenous cannula. Even if an inhalational induction is used, this allows smoother cannula placement during lighter stages of anaesthesia. Ideally, delivery of pre-emptive oral analgesics prior to arrival in theatre helps prevent the physiological effects of nociceptive transmission but does entail a degree of coordination that may not be achievable in many busy units.

Good psychological preparation and parental presence at induction increases cooperation. Consequently, use of premedication in the UK is low. However, certain children may benefit from a short-acting sedative (e.g. developmental delay, previous traumatic experiences, unduly anxious child). Sedation can lead to a smoother induction process and reduce emergence delirium. Giving sedation during day-case surgery is not contraindicated, but careful planning is required to ensure it is given time to work, and the logistics of transferring a sedated child does not increase the pre-induction time.

Midazolam is commonly used. If given orally at a dose of 0.5 mg/kg (maximum of 20 mg) it has an onset time of 20–30 minutes and is best diluted in a flavoured liquid due to its bitter taste. It is available as buccal or intranasal preparation at a dose of 0.2–0.3 mg/kg with a slightly quicker onset of 10–20 minutes. This is especially useful in a non-compliant child that refuses to swallow the oral suspension but if given intranasally can smart a little on administration.

Other agents include oral clonidine (α -2 agonist) at 4 μ g/kg which has a longer onset time of 45 minutes. It is associated with prolonged drowsiness in recovery that is undesirable in day surgery settings but can decrease postoperative pain and shivering. Another α -2 agonist, dexmedetomidine, is becoming more widely used due to its more favourable pharmacokinetic profile and can also be given intranasally at 2 μ g/kg.

Induction and maintenance

Induction of anaesthesia in children remains a fluid affair dependent on the anaesthetist and patient (and parental) preferences, which often change from ward to anaesthetic room. Neither intravenous nor inhalational induction confers any proven benefit over the other in terms of adverse reactions or

recovery profile in a day-case setting. Most establishments now use sevoflurane or desflurane for maintenance as they exhibit enhanced wake-up profiles secondary to low blood gas solubility, though this has yet to be shown to translate to earlier discharge home. It is proven that both agents result in greater emergence delirium than intravenous propofol. Total intravenous anaesthesia (TIVA) is becoming more popular with the development of paediatric specific mathematical models for plasma targets, and in children with mild upper respiratory tract symptoms propofol may be associated with a significant reduction in perioperative respiratory events when compared with sevoflurane.¹¹

Airway

Supraglottic airway devices (SADs) are now standard across day-case surgery. The SAD was not specifically designed for paediatric practice. Paediatric SADs are scaled-down models based on adult anatomy, which explains the propensity of poor fit and dislodgement as you descend down the sizes. Below the age of 1 year (especially below 6 months) the likelihood of problems such as obstruction, and laryngospasm are higher and they should be used with caution with a high degree of vigilance.

Analgesia

Pain following ambulatory surgery is widely documented to be poorly managed at home. It is the subject of several papers and a large audit supported by the APAGBI looking into what factors govern this (listed in [Box 2](#) and see Further reading). The mainstay of pain relief in day surgery settings is provided using multimodal techniques of simple analgesics with local anaesthesia adjuncts.

Factors affecting paediatric pain control at home

Child factors

- Refusing to take medicine
- Sleeping when regular medication is due

Parental factors

- Pain assessment difficulties
- Knowledge/education (worried about addiction)
- Culture (stoical behaviours expected)

Medication

- Inadequate formulations (tablets versus suspension)
- Taste
- Ineffective (dose banding not adequate or degree of pain versus analgesic)

Hospital system

- Poor discharge information (no written instructions)
- Access to analgesics (stronger analgesics require ongoing prescription)

Box 2

Paracetamol is the most widely used analgesic and has recently been under considerable scrutiny. Guidance statements by the APA (see Further reading) provide comprehensive information regarding current policies but is summarized in [Tables 1](#) and [2](#). It should be noted that the previously recommended daily maximum of 90 mg/kg has been lowered.

There should be a distinction between in and out of hospital doses as there is less control and monitoring in the latter. This is further compounded at discharge by hospital pharmacies using age dose banding rather than weight to provide parents with standardized information. This inevitably does not take lean body mass into account and can lead to either suboptimal analgesia or even overdose in some cases.

Non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen or diclofenac are licensed for children over 3 months in the UK. They are safe, effective and popular in the day-case setting and have been shown to decrease the use of opioids and extending their value beyond analgesia to sparing postoperative nausea and vomiting (PONV). Combination therapy (paracetamol and NSAIDs) is better than either drug alone.

Traditionally, the next analgesic step was the addition of weak opioids. Codeine is no longer being used in children below 12 years of age and not in any child under 18 years with OSA undergoing adeno-tonsillectomy (see Further reading). This is due to its unpredictable metabolism that has caused fatal delayed respiratory depression. It remains a problematic area, as there is no quality data or consensus of opinions as to what alternatives are to be used, especially for day-case adeno-tonsillectomies. Other opioids (e.g. dihydrocodeine) are likely to have similar metabolism with currently unknown safety profiles. Tramadol is used in Europe but is not licensed for children under 12 years in the UK and child-friendly preparations are difficult to access presently.

Intraoperative use of opioids are limited to avoid the inevitable consequences of respiratory depression, sedation and PONV. The rate of PONV increases even after one dose of morphine in children. When opioids are used (as is necessary in some surgeries) preference is given to shorter-acting opioids such as fentanyl (1–2 µg/kg).

Oral morphine can be used to good effect and current hospital dosing schedules are of the order of 200 µg/kg every 4 hours according to response. Many clinicians are uneasy at discharging children home on these doses and current discharge doses range between 100 and 200 µg/kg in 4 hours. Using morphine post-operatively requires a period of up to 4 hours observation post dose in hospital, which may delay discharge. Prescribing take-home morphine (being a controlled drug) also raises many administration and logistical problems for home discharge.

Advances in ultrasound technology have expanded the role of regional anaesthesia in paediatrics, allowing the accurate placement of small volume local anaesthetic for both truncal and peripheral nerve blocks providing targeted pain relief with fewer side effects.¹² There is substantial evidence to support both their safety and efficacy.¹³ The most established regional technique in paediatric practice is the one-shot caudal epidural. It remains an effective modality of analgesia for most lower abdominal/pelvic/lower limb surgery at a dose of 0.8 ml/kg of 0.25% levobupivacaine, with side effects of weak legs and urinary retention rarely seen. Addition of clonidine to lengthen block duration is

Oral paracetamol dosing regime

	28–32 weeks PCA	32–52 weeks PCA	3 months–6 years	6–12 years	12–18 years
Maintenance (mg/kg)	10-15 (8–12 h)	10-15 (6–8 h)	15-20 (4–6 h)	15-20 (4–6 h)	1 g (6 h)
Daily allowance	30 mg/kg	60 mg/kg	75 mg/kg	75 mg/kg	Max 4g

Table 1

Intravenous paracetamol dosing regime

	Preterm Neonate > 32 weeks PCA	Term neonate	< 10 kg body weight	> 10–50 kg	> 50 kg
Maintenance dose (mg/kg)	7.5 (8 h)	10 (4–6 h)	10 (4–6 h)	15 (4–6 h)	1 (4–6 h)
Daily allowance	25 mg/kg	30 mg/kg	30 mg/kg	60 mg/kg	Max 4g

Table 2

not practised in the day-case setting to avoid the sedative side effects. Local anaesthetics are also effective if administered into wounds or topically, e.g. eye drops in this setting.

Postoperative nausea and vomiting

PONV is the leading cause of unexpected hospital admission postoperatively and is twice as likely in paediatric patients than in the adult population (see Further reading). Preoperatively, the risks of PONV should be assessed: PONV is more likely in children above 3 years, increasing into adolescence (girls especially). Previous PONV, motion sickness or familial predisposition also increase the risk. Adeno-tonsillectomies and strabismus surgeries remain highly emetogenic. Volatile anaesthesia may increase PONV and provision of TIVA should be considered for higher risk children.

Aggressive prophylaxis is required and the first-line medication is ondansetron (0.15 mg/kg). If a child is deemed high risk then the addition of dexamethasone (0.15 mg/kg) is recommended. Droperidol (0.025 mg/kg) is suggested by the APAGBI for high-risk patients who cannot receive dexamethasone, and for the treatment of established postoperative vomiting in those who have already received ondansetron. Anxiety remains regarding extrapyramidal side effects. Maintaining normal

hydration decreases the incidence of PONV and removing the mandatory fluid intake prior to discharge has lessened the incidence of vomiting.

Discharge and follow-up

Nurse-led discharge from day surgery units is common but requires experienced staff. They follow strict protocols prior to discharge (Box 3). Next-day telephone follow-up should be attempted in all cases to capture immediate postoperative complications (hospital admissions to other establishments are often missed in follow-up data). The calls decrease the burden on primary care as well as increasing patient satisfaction with the process. It provides valuable audit data so that units can engage in continuing to develop and improve standards ensuring up to date information on postoperative symptoms at home and unplanned admission rates. Despite all the above strategies unplanned admission rates are currently between 1% and 2% but may rise in units dealing with more complex patients and procedures. ◆

Discharge criteria for day-case surgery

- Stable vitals and conscious level
- Pain controlled, discharge medicines supplied and parents educated in their regular use
- Nausea/vomiting controlled
- Hydration attained (intraoperative fluid, postoperative drink not enforced)
- Passing urine if relevant (post caudal or penile surgery)
- Wound clean and no bleeding
- Parents happy to take home
- Written information, discharge summary and telephone number supplied

Box 3

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