Children are excellent candidates for day-case management as they are usually healthy and predominantly require minor or intermediate surgery of short duration. The cost effectiveness of day-case surgery has put this mode of care at the top of the political agenda in many industrialised countries. For example, the UK Government has recently declared that 75% of all surgery, including children’s surgery, should be performed on a day-stay basis.

Besides the economic benefits, day-case management is highly advantageous for child and family. The psychological impact of inpatient admission cannot be overestimated. Problems, such as nocturnal enuresis and disrupted sleep patterns, are commonplace and are decreased by day-case management. Hospital-acquired infection is also reduced by avoiding in-patient admission. This is particularly beneficial for immunocompromised children.

A successful paediatric day-case service is one which minimises postoperative morbidity, has low in-patient admission rates and demonstrates high parental and child satisfaction. Good quality anaesthesia is essential to achieving these goals with experienced clinicians working in child-friendly facilities. Anaesthesia is frequently the lead speciality in paediatric day-case services, developing selection criteria protocols, postoperative symptom control regimens and co-ordinating audit activity.

Selection criteria

Selection criteria should be developed focusing on four key areas: the patient, procedure, family and anaesthetic considerations. Exclusions for day surgery are listed in Table 1.
defects may be suitable with appropriate bacterial endocarditis antibiotic prophylaxis.

Glycaemic control in children with insulin-dependent diabetes or inborn errors of metabolism may be complicated in the peri-operative period making these conditions a relative contra-indication to day-case management. Many children (20–30%) have a ‘runny nose’ for a large proportion of the year. Cancellation of this entire group confers no advantage, as many of the cases are due to benign, non-infectious seasonal rhinitis or adenoidal hypertrophy. However, it is important to exclude patients with significant respiratory infection as anaesthetising such children may risk peri-operative complications such as laryngospasm, bronchospasm or atelectasis. This applies particularly to infants.

All children with moderate or severe respiratory infection should be postponed. Clinical indicators of severity include productive cough, purulent nasal secretions and clinical signs of systemic infection including fever and malaise. In the presence of mild infection, it is reasonable to proceed with surgery. However, a low threshold for cancellation should apply if there is bronchospasm, if the procedure requires tracheal intubation or if the patient is under 1 year old. If the procedure is deferred, the child should be rescheduled 2 weeks after resolution of upper respiratory symptoms or 4 weeks later if the lower respiratory tract was involved.

The lower age limit for day surgery depends on various factors, including post-conceptual age, experience of the anaesthetist and the day-case facilities. Healthy, term infants may be anaesthetised for minor procedures as day-cases provided paediatric anaesthetists are involved and in-patient neonatal care is available, if required. Pre-term or former pre-term infants are not suitable for day care as they are at risk of postoperative apnoeic episodes necessitating in-patient observation. The age at which former pre-term infants may be safely managed as day-cases is unknown but most authorities will not contemplate it until the child is at least 50 weeks’ post conceptual age, or older if there is evidence of chronic lung disease (e.g. bronchopulmonary dysplasia).

The family

The social circumstances of the child and its family are critical to successful day surgery. Unduly anxious parents and single parents with several children may feel unable to cope with their child returning home soon after surgery. Families should not live far from the hospital (< 1 h by car) and should have access to a telephone and transport to enable return to hospital, if necessary.

Anaesthetic considerations

Prolonged anaesthesia, even with modern agents, should be avoided to minimise problems with vomiting and delayed recovery. Arbitrarily, procedures likely to exceed 1 h are, therefore, excluded from day surgery. Previous anaesthetic problems or an anticipated difficult airway may preclude day surgery. However, the final judgement needs to be made by experienced personnel.

Pre-operative screening and investigations

An efficient system of pre-operative assessment benefits the child and family as well as the day-case service. Admission on the day of surgery is facilitated which decreases stress for the child and avoids preventable cancellation. It is not feasible for all patients to be screened by an anaesthetist, although they should remain the final arbiter of suitability for day surgery. Nurse-led assessment utilising questionnaires completed by parents is popular and works very successfully in many UK centres. Telephone screening and computer-based questionnaires can also be used. All children must be reviewed by the surgeon and anaesthetist on admission to confirm the advisability of proceeding on the day of surgery.
Routine pre-operative investigations are unnecessary, as the majority of children are healthy. Sickle cell screening remains a commonly performed investigation for day-case children.

**Psychological preparation**

As the interval between admission and anaesthetic induction is short, there is little chance to orientate the child to the day’s events. Sedative premedication is not commonly used for day cases and so careful psychological preparation of the child takes on added importance. Programmes utilising play simulation, video presentations and visits to the day unit have all been found to improve peri-operative behaviour.

**Anaesthetic management**

**Premedication**

Although most children are not sedated before day surgery, unduly anxious children or those with learning difficulties may benefit from premedication. Traditional premedicants are unsuitable, as they tend to produce excessive postoperative sedation. Considerable interest has surrounded the use of oral midazolam (0.5 mg kg\(^{-1}\)). This produces effective sedation within 10–30 min, improving behaviour at induction but without delaying recovery or discharge. Cutaneous anaesthesia with either tetracaine gel (Ametop) or a eutectic mixture of lidocaine and prilocaine (EMLA) has vastly increased intravenous induction for paediatric day-cases. EMLA should be applied at least 60 min before IV cannulation whereas Ametop has a more rapid onset (45 min) and less tendency to produce venoconstriction.

**Pre-induction techniques**

Occasionally, last minute pre-operative sedation is required for a very unco-operative younger child. With parental consent, intramuscular ketamine in low dose (2 mg kg\(^{-1}\)) with an onset of 3–5 min can be useful. There is little effect on recovery time and minimal emergence delirium. Older children who refuse to co-operate should not be restrained for induction but deferred for further counselling with their parents.

**Induction**

The choice of technique depends on the needs of the individual child with the goal of producing smooth, atraumatic induction. Parental presence helps both the child and the anaesthetist in achieving these aims.

Inhalational induction is useful for children with difficult venous access or those with needle phobia. Transparent face-masks coated with food flavourings improve acceptability. Sevoflurane with its pleasant odour, non-irritating airway properties and rapid onset of action has probably replaced halothane as the first choice agent.

Propofol (up to 4 mg kg\(^{-1}\)) effectively obtunds airway reflexes facilitating easy insertion of the laryngeal mask airway (LMA). The major drawback of pain on injection can be minimised by the addition of lidocaine (0.2 mg kg\(^{-1}\)) prior to use or by using a large vein. Thiopental (5–6 mg kg\(^{-1}\)) can also be used but may slightly delay initial recovery and produces less favourable conditions for LMA insertion.

**Maintenance**

A maintenance technique using nitrous oxide, oxygen and a volatile agent is entirely satisfactory with little to choose between the established volatile agents. Although sevoflurane and desflurane produce more rapid initial recovery, they can be associated with a higher incidence of emergence agitation. TIVA with propofol has definite advantages in some cases (e.g. strabismus correction where PONV is a major problem). Knowledge and experience of TIVA in children is not as advanced as it is in adult practice and is the subject of continuing clinical research.

**Airway management**

The LMA has many advantages for paediatric day surgery. Neuromuscular blocking drugs are avoided, as are problems such as extubation stridor. Head and neck procedures including strabismus correction, ENT and dental surgery can be managed with the re-inforced version of the LMA. However, the potential for prion contamination during adenotonsilair surgery has made this option for airway management expensive as the LMA must be disposed of after single use.

**Fluid management**

Liberal starvation regimens for oral fluids have made pre-operative dehydration and hypoglycaemia uncommon these days. However, peri-operative IV hydration is beneficial if children have been starved excessively, for those procedures associated with excessive postoperative nausea and vomiting (PONV) or if there is a risk of significant peri-operative haemorrhage.
**Peri-operative analgesia**

**Local anaesthesia**

Useful techniques include topical application, local infiltration, peripheral nerve blocks and caudal epidural blockade. Tetracaine eye drops provide excellent analgesia after squint surgery while lidocaine ointment works well after circumcision. Wound infiltration is easily performed and should not be underestimated as an effective analgesic technique. Although many peripheral nerve blocks are feasible, only a few are regularly practised in day-case surgery.

**Penile block**

Penile block is becoming popular for circumcision and minor hypospadias surgery. Blockade of the dorsal penile nerves using a two-injection technique deep to Buck’s fascia at the base of the penis is optimal to ensure consistent spread of local anaesthesia in the subfascial compartment.

**Ilioinguinal–iliohypogastric block**

Ilioinguinal–iliohypogastric nerve block provides excellent analgesia after inguinal herniotomy and the groin incision made for orchidopexy (the scrotal incision requires additional local infiltration). There is a 5–10% incidence of associated femoral nerve block resulting in leg weakness, which may delay mobility of older children.

**Greater auricular nerve block**

Greater auricular nerve block with subcutaneous infiltration between the mastoid process and the descending ramus of the mandible provides excellent pain relief after otoplasty.

**Caudal epidural block**

Caudal epidural block is widely used for day surgery. It provides excellent analgesia for most procedures below the umbilicus. There is potential for lower limb weakness delaying discharge which can be minimised by using dilute local anaesthetic solutions (e.g. bupivacaine 0.125%). The addition of clonidine (1–2 µg kg⁻¹) doubles while ketamine (0.5 mg kg⁻¹) quadruples duration of local analgesia with minimal side-effects making these adjuncts suitable for day case use.

**NSAIDs and paracetamol**

Diclofenac (1 mg kg⁻¹) and ibuprofen (5–10 mg kg⁻¹) are the most commonly used NSAIDs either given as oral premedication or rectally after induction of anaesthesia. NSAIDs can be safely used in the majority of children with asthma, particularly if they have taken NSAIDs previously without causing an exacerbation. The exception are those with the triad of known NSAID sensitivity, asthma and nasal polyps. Paracetamol is universally used; a loading dose of 20 mg kg⁻¹ pre-operatively or 40 mg kg⁻¹ rectally after anaesthetic induction is appropriate.

**Opioids**

The routine use of long-acting opioids is inadvisable as it causes significant morbidity, notably excessive sedation and vomiting. Fentanyl (1–2 µg kg⁻¹ IV) or codeine (1 mg kg⁻¹ orally/rectally) are useful agents for day-cases.

**Postoperative nausea and vomiting**

Commonly performed day-case procedures are associated with a high incidence of PONV (e.g. orchidopexy, otoplasty, squint surgery). Apart from the surgical procedure, other risk factors for PONV include previous history, motion sickness and early postoperative mobilisation. Reduction in PONV can be achieved by minimising exposure to known precipitants (e.g. opioids) and treating the high-risk patient prophylactically. Ondansetron (0.1 mg kg⁻¹) is particularly suitable as it is non-sedating and does not produce extrapyramidal side effects. Dexamethasone (0.1 mg kg⁻¹) has useful synergistic action in difficult PONV cases.

**Postoperative management**

**Discharge criteria**

Children may be discharged when their vital signs are stable, pain and nausea are well controlled and there are no surgical problems. Many centres have required children to drink prior to discharge. However, studies have shown that there is no excess morbidity in children who refuse to drink provided they have received peri-operative IV hydration. Similarly, the ability to pass urine has been challenged and is now only required on surgical grounds (e.g. following penile surgery).
Analgesia following discharge

Paracetamol and NSAIDs are the mainstays of pain relief after return home (Table 2). Topical preparations such as lidocaine ointment following circumcision are also effective. Parents should be instructed to administer analgesia regularly rather than waiting for the child to become excessively uncomfortable.

Reasons for in-patient admission

The commonest problems requiring in-patient admission are intractable vomiting and severe pain. A widely quoted benchmark for in-patient admission is 1–2%. The possibility of admission should always be discussed with parents at the screening stage.

Table 2 Post discharge oral analgesia

<table>
<thead>
<tr>
<th>Age group</th>
<th>Analgesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 year</td>
<td>Paracetamol 15 mg kg⁻¹ qds</td>
</tr>
<tr>
<td>1–10 years</td>
<td>Paracetamol 15 mg kg⁻¹ qds ± Ibuprofen 5–10 mg kg⁻¹ qds ± Codeine elixir 0.5 mg kg⁻¹ qds</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>Compound paracetamol/codeine preparations (e.g. cocodamol) ± Ibuprofen 200–400 mg qds</td>
</tr>
</tbody>
</table>

Quality control in day surgery

Day surgical activity should be subject to audit focusing on the quality of care as measured by the following parameters:

- Cancellation
- Unanticipated admissions and hospital re-attendance
- Postoperative morbidity (e.g. pain, PONV)
- Postoperative GP consultations
- Resumption of normal activity
- Parental and child satisfaction

Key references


See multiple choice questions 95–98.