Approaches to anaesthesia protocols

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ABSTRACT

While drugs are important in anaesthesia protocols, they are only one aspect of patient management in the peri-anaesthetic period. When constructing an anaesthesia protocol, an understanding of potential problems associated with the patient such as age, breed, size, health status and temperament is essential. In addition, surgical and non-surgical procedures pose many different problems for the anaesthetist which must be anticipated and managed. For routine procedures such as neutering in healthy adult patients, anaesthesia protocols can be planned in advance, taking into account the needs of most patients and the problems associated with the procedure. But for sick patients or unusual procedures, the anaesthetic management should be designed on an individual basis. Attention to individual patient requirements is essential for any anaesthetic.

PERUSAL of the *Oxford English Dictionary* online reveals several meanings for the word “protocol”.

The definition relevant to this article is “a procedure for carrying out a scientific experiment or course of medical treatment”. It is worth highlighting the word “procedure” in that definition.

When considering protocols for anaesthesia in small animal patients, we often become fixated on pharmacological management. However, little evidence suggests the choice of drugs has any bearing on the outcome. An understanding of problems associated with the patient, the pathophysiology of concurrent disease and the proposed procedure are essential for successful anaesthesia, with the choice of drugs often a secondary consideration.

Designing an anaesthesia protocol
Figure 1. Volume resuscitating a severely hypovolaemic dog prior to anaesthesia.

The foundation of safe anaesthesia is preparation. Assessing the patient and considering the procedure to be performed enables anticipation of problems in the peri-anaesthetic period. Measures to address these problems can then be undertaken, either immediately – such as volume-resuscitating a hypovolaemic patient (Figure 1) – or by formulating a plan to deal with a potential problem, such as having a tracheostomy kit available for a brachycephalic patient.

For routine cases, such as neutering healthy young adults, potential problems will be broadly the same for all patients, so that management protocols can be set up in advance. The protocol must be optimal for patient safety, but also practical and affordable. Even so, attention to the individual patient’s needs is required. For example, a chihuahua bitch will require more insulation and patient warming to prevent hypothermia than a Rhodesian ridgeback.

For more complex cases, a management plan should be tailored to individual patients to try to minimise complications and prepare for potential adverse events.

General management

Withholding food and water

Except for emergencies, dogs and cats should probably be starved for about six to eight hours prior to anaesthesia, and water withheld for about one to two hours. Starving for longer than 10 hours increases the acidity of stomach contents and the risk of oesophagitis (Savvas et al, 2009). For young puppies and kittens, the period of starvation should be reduced to about three to four hours to prevent hypoglycaemia.

IV access
Most anaesthetics in cats and dogs are induced using intravenous techniques (Brodbelt, 2006). Placing an IV catheter has many advantages, including less stressful induction of anaesthesia for the patient and personnel with easier titration to effect, avoidance of perivascular injection and easy administration of induction agent “top ups”, IV fluids, additional analgesia intra-operatively, and emergency drugs (Figure 2).

Figure 2. Stress-free induction of anaesthesia via an IV catheter.

**Endotracheal intubation**

Tracheal intubation is necessary for controlling the airway, positive pressure ventilation, and provision of inhalational agents and oxygen with minimal pollution.

Counter-intuitively, tracheal intubation in cats has been associated with an increased risk of death, although this effect was less pronounced for major procedures compared to minor procedures (Brodbelt et al, 2007).

This suggests that for short procedures in cats, intubation may not be necessary. Intubation in cats is difficult and can cause laryngeal injury, oedema and laryngospasm. It must be performed with care to minimise complications.

**Monitoring**
The most important patient monitoring factor during anaesthesia is a separate person dedicated to this purpose. Good monitoring enables anaesthetic problems to be detected and corrected before they become life threatening.

For cats, using pulse oximetry and monitoring the pulse was associated with a reduced risk of death (Brodbelt et al, 2007). Use of other monitoring was so infrequent that it could not be analysed. The anaesthetic does not finish when the vaporiser is switched off, and monitoring should be continued into recovery, with the intensity of monitoring depending on the animal’s health status and the risks associated with the procedure (Figure 3).

More than 50 per cent of anaesthesia-related deaths occur after anaesthesia, with around half of these deaths happening within three hours of the end of the anaesthetic (Brodbelt, 2006). This suggests room for improvement in patient care in the postanaesthetic period.

Temperature control
All small animal patients are at risk of hypothermia in the perianaesthetic period, particularly cats, small dogs and patients undergoing laparotomy or thoracotomy (Figure 4). Small animals may start to become hypothermic following administration of the pre-anaesthetic medication. Warming these patients at this stage may help to reduce hypothermia under anaesthesia.

Large dogs may become hyperthermic, especially in warm weather and when using a rebreathing system. Hyperthermic patients require a higher dose of inhalation agent and often pant during anaesthesia. Provision of a fan and sedation will cool patients prior to the anaesthetic.

**Pharmacological management**

When considering currently used sedative and anaesthetic agents, familiarity with the drugs is more important than the choice of drugs (Brodbelt, 2006). To choose appropriate drugs for a particular patient, a basic understanding of their pharmacology is required.

**Pre-anaesthetic medication**

The use of pre-anaesthetic medication has been associated with a decreased risk of death, compared to no pre-anaesthetic medication (Brodbelt, 2006; Clarke and Hall, 1990). Good pre-anaesthetic medication reduces patient stress, provides analgesia and reduces anaesthetic agent requirement. This is particularly important in sick and elderly patients. Suggested doses are shown in Table 1.
Table 1. Drugs and doses often used for pre-anaesthetic medication or co-induction by the author.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose range cats</th>
<th>Dose range dogs</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IM</td>
<td>IV</td>
<td>IM</td>
</tr>
<tr>
<td>Acepromazine (µg/kg)</td>
<td>10-30</td>
<td>10-30</td>
<td>10-30</td>
</tr>
<tr>
<td>Medetomidine# (µg/kg)</td>
<td>5-20</td>
<td>-</td>
<td>2-10</td>
</tr>
<tr>
<td>Desmedetomidine# (µg/kg)</td>
<td>2.5-10</td>
<td>1-5</td>
<td>1-5</td>
</tr>
<tr>
<td>Midazolam* (mg/kg)</td>
<td>0.1-0.3</td>
<td>0.1-0.3</td>
<td>0.1-0.3</td>
</tr>
<tr>
<td>Diazepam* (mg/kg)</td>
<td>0.3-0.5</td>
<td>-</td>
<td>0.3-0.5</td>
</tr>
<tr>
<td>Butorphanol (mg/kg)</td>
<td>0.2-0.3</td>
<td>0.2-0.3</td>
<td>0.2-0.3</td>
</tr>
<tr>
<td>Buprenorphine (µg/kg)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Pethidine (mg/kg)</td>
<td>2.5</td>
<td>-</td>
<td>1-5</td>
</tr>
<tr>
<td>Methadone# (mg/kg)</td>
<td>0.2-0.5</td>
<td>0.1-0.3</td>
<td>0.2-0.5</td>
</tr>
<tr>
<td>Morphine* (mg/kg)</td>
<td>0.2-0.5</td>
<td>0.1-0.3</td>
<td>0.2-0.5</td>
</tr>
</tbody>
</table>

Key: * = drug not licensed. # = dose different to licensed dose.

Use of acepromazine has been associated with a decreased risk of mortality in dogs and cats (Brodbelt et al, 2006; Clarke and Hall, 1990).

However, this does not mean acepromazine should be used in every anaesthetic protocol. The main disadvantage of acepromazine is alpha-1 adrenoceptor antagonism, which causes peripheral vasodilation and hypotension. Most healthy patients can cope with this, but acepromazine is contraindicated in dehydrated and hypovolaemic patients (which are reliant on peripheral vasoconstriction to maintain normotension and normal cardiac output).

Reports of xylazine use being associated with anaesthesia-related deaths (Clarke and Hall, 1990) gave alpha-2 adrenoceptor agonists a bad name. More recently, medetomidine was not associated with an increased risk in dogs and cats (Brodbelt, 2006). Xylazine is less alpha-2 specific than medetomidine and dexmedetomidine, and may sensitise the heart to catecholamine-induced arrhythmias, possibly accounting for the apparent difference in safety.

However, it is likely that we have learned to use these drugs more safely due to better understanding of their pharmacology. All the effects of alpha-2 adrenoceptor agonists are dosedependent. The most significant adverse effect is vasoconstriction, which causes a baroreceptor-mediated bradycardia and a significant drop in cardiac output. These drugs should not be used in patients that have a reduced cardiac output, such as hypovolaemic and sick animals. Patients with cardiac disease and geriatrics are less able to tolerate the increased afterload. Paediatric patients do not cope well with bradycardia. Alpha-2 adrenoceptor agonists reduce insulin production and should be avoided in diabetic patients.

The cardiovascular effects are maximal following a dose of 5ig/ kg medetomidine IV in dogs. At higher doses the effects do not significantly increase, but have a longer duration (Pypendop and Verstegen, 1998). Higher doses markedly reduce induction agent requirements and slow speed of induction, so that administration of induction agents slowly to effect is imperative. Doses below 5µg/kg IV result in mild to moderate sedation and do not cause such a profound drop in cardiac...
Intramuscular administration tends to produce less severe cardiovascular effects than IV administration. Use of low-dose medetomidine or dexmedetomidine IM provides a useful alternative to acepromazine for pre-anaesthetic medication.

Benzodiazepines (diazepam and midazolam) cause minimal cardiovascular effects. Unfortunately, they are not reliable sedatives, and in healthy adults they can cause excitement. Sedation is much more reliable in very young and very old patients, and sick animals. They are useful IV co-induction agents to minimise the doses of induction and inhalation agents.

Opioids are appropriate for almost any patient or procedure. They provide analgesia and sedation with minimal cardiovascular and respiratory effects in small animals. They are useful for pre-anaesthetic medication in sick or geriatric patients and can be used alone for this purpose. Intramuscular or IV administration (not pethidine) generally results in better absorption than SC injection.

**Inhalational agents**

In dogs, isoflurane has been associated with a reduced risk of death compared to halothane (Brodbelt, 2006). Induction of anaesthesia by mask is associated with an increased risk of death in dogs compared to induction using an injectable agent (Brodbelt, 2006).

One study has demonstrated more severe haemodynamic depression in hypovolaemic dogs following mask induction with isoflurane, compared with intravenous induction with ketamine/diazepam or propofol/diazepam (Fayyaz et al, 2009).

**Analgesics**

Several NSAIDs are licensed for pre-anaesthetic use in dogs and cats, and provide good perioperative analgesia. The health status of the patient and risks associated with the procedure should be considered when deciding whether to administer NSAIDs pre-operatively.

If hypotension is a significant risk during the anaesthetic, it may be prudent to delay administration until recovery to prevent gastrointestinal and renal side effects. The licensed doses and dose intervals should not be exceeded.

**The patient**

Age, breed, bodyweight, temperament and health status all influence management in the peri-anaesthetic period.
Age

Figure 5. This 10-week-old whippet responded well to pre-anaesthetic medication with midazolam 0.1mg/kg IM and butorphanol 0.1mg/kg IM.

Dogs and cats aged 12 years or more have a higher anaesthetic risk than other adult patients (Brodbelt, 2006).

Geriatric patients are often affected by concurrent disease that may be subclinical, such as endocrine or renal disease.

The geriatric cardiovascular system is less able to cope with the effects of anaesthetic agents, and hypotension under anaesthesia is likely.

Older patients are more susceptible to hypothermia and may have a reduced capacity for drug metabolism, causing prolonged recoveries (Neiger-Aeschbacher, 2007). An IV catheter should be placed to facilitate intravenous fluid therapy (IVFT) before, during and after general anaesthesia.

Pre-anaesthetic medication is important to reduce the dose and, therefore, the cardiovascular
effects of induction and inhalation agents. Consider using a low dose of acepromazine or omit it from the pre-anaesthetic medication to avoid hypotension, hypothermia and prolonged recovery. However, acepromazine is very useful for calming anxious animals.

Since older patients may be more sensitive to sedation, preanaesthetic medication using an opioid alone may be sufficient. However, a benzodiazepine could be considered in addition, such as midazolam IM or as an IV co-induction agent.

Paediatric patients have immature cardiovascular, respiratory, thermoregulatory and sympathetic nervous systems, which respond differently to anaesthesia and stress. They are more susceptible to hypoglycaemia when food is withheld prior to anaesthesia. Patients less than about eight weeks old may have immature hepatic and renal systems influencing drug metabolism and excretion. Young patients are often more sensitive to the sedative effects of opioids, which are thus useful for pre-anaesthetic medication, and also usually respond well to sedation with benzodiazepines (Figure 5).

**Breed**

<table>
<thead>
<tr>
<th>Breed</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>English bulldog, French bulldog, pug and other brachycephalic breeds.</td>
<td>Upper airway obstruction at any point in the peri-anaesthetic period except when intubated. Increased risk of regurgitation, liability to thermoregulate efficiently by panting. Dynamic upper airway obstruction due to stress and panting.</td>
<td>IV access, pre-oxygenate, rapid induction and intubation, late extubation, prepare laryngoscope and several diameter smaller ETTs. Consider use of anaesthetics, minimise period of starvation. Keep cool while hospitalized. Keep calm and cool.</td>
</tr>
<tr>
<td>English bull terrier.</td>
<td>Difficult intubation.</td>
<td>IV access, pre-oxygenate, induce slowly to prevent apnoea. Laryngoscopy, have IV induction agent top-ups available.</td>
</tr>
<tr>
<td>Newfoundland, St Bernard, Shetland sheepdog, Japanese akitas etc.</td>
<td>Hyperthermia.</td>
<td>Cold IV fluids, patient cooling and high fresh gas flow rates.</td>
</tr>
<tr>
<td>Dachshund, basset hound.</td>
<td>Difficult IV access.</td>
<td>Consider the lateral auricular vein.</td>
</tr>
<tr>
<td>Dachshund.</td>
<td>Often bradycardic when anaesthetised.</td>
<td>Monitor blood pressure, administer an anticholinergic agent if hypotensive.</td>
</tr>
</tbody>
</table>

**Table 2.** Examples of breed or type-specific anaesthesia problems.

Despite popular lay opinion, breed-specific pharmacological effects are rare. Prolonged recovery from barbiturate anaesthesia in sight hounds is well documented (Robinson et al, 1986).

Greyhounds also recover more slowly from propofol anaesthesia than other breeds, although recovery times are clinically acceptable (Robertson et al, 1992). Brachycephalic breeds, especially boxers, may experience vasovagal syncope due to alpha-1 adrenoceptor blockade. This can be avoided by using a low dose of acepromazine or by concurrent use of atropine (20µg/kg to 40µg/kg IM).

Large-breed dogs seem to be more sensitive to the sedative effects of acepromazine, although this is probably due to allometric scaling, rather than breed-specific differences. Low doses should be
used in larger dogs. The dose of induction agent varies with the size of the dog, with larger dogs often requiring less than the data sheet dose, emphasising the need to administer propofol (Jolliffe et al, 2008) and probably alfaxalone slowly to effect.

Non-pharmacological breed or type-specific considerations are common, and examples are shown in Table 2. Brachycephalic breeds deserve special consideration due to multiple potential anaesthetic problems.

**Weight/size**

Cats weighing less than 2kg or more than 6kg, and dogs weighing less than 5kg, have an increased anaesthetic risk (Brodbelt, 2006). Small patients are at increased risk of drug overdose and may be too small for some equipment – for example, the dead space in the breathing system may be large compared to the patient’s tidal volume.

Careful choice of the anaesthetic breathing system and endotracheal tube minimises dead space and resistance. Monitoring is often challenging: it is more difficult to palpate a pulse or observe the reservoir bag to count the respiratory rate. Blood pressure cuffs are often too large and oscillometry may not work reliably. It is often more difficult to access these small patients at all when covered by surgical drapes. Any obese patient has a reduced functional residual capacity, resulting in increased likelihood of cyanosis during induction of anaesthesia since the oxygen reserve in the lungs is diminished. Pre-oxygenation prior to anaesthesia induction will help address this problem.

**Temperament**

<table>
<thead>
<tr>
<th>Sedation</th>
<th>Opioid for non-painful procedure</th>
<th>Opioid for painful procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Acepromazine 20µg/kg + medetomidine 10µg/kg + opioid</td>
<td>Butorphanol 0.2mg/kg</td>
</tr>
<tr>
<td>Cat</td>
<td>Medetomidine 10µg/kg to 20µg/kg + Ketamine 5mg/kg + opioid</td>
<td>Butorphanol 0.2mg/kg</td>
</tr>
<tr>
<td>Cat</td>
<td>Alfaxalone 2mg/kg to 5mg/kg + opioid</td>
<td>Butorphanol 0.2mg/kg</td>
</tr>
</tbody>
</table>

Table 3. Examples of pre-anaesthetic medication for aggressive patients (all administered IM).

An aggressive temperament is likely to influence the pharmacological management of the patient. A thorough physical examination may be impossible. Aggressive patients often require heavy IM
sedation, followed by a much-reduced dose of IV induction agent – or IM induction of anaesthesia (Table 3).

Health status

Patients may be categorised according to their physical status using the American Society of Anesthesiologists (ASA) physical status classification system (Table 4). Patients of ASA grades one and two are essentially healthy, while those of ASA grades three, four and five are considered sick. Sick cats and dogs are at a significantly higher risk of death than healthy patients (Brodbelt et al, 2007; 2008).

<table>
<thead>
<tr>
<th>ASA grade</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Healthy</td>
<td>Healthy patient for hip scoring or neutering.</td>
</tr>
<tr>
<td>2</td>
<td>Mild systemic disease that does not limit function.</td>
<td>Controlled epileptic patient.</td>
</tr>
<tr>
<td>3</td>
<td>Severe systemic disease that limits function.</td>
<td>Patient with poorly controlled diabetes mellitus.</td>
</tr>
<tr>
<td>4</td>
<td>Severe systemic disease that is a constant threat to life.</td>
<td>Dyspnoeic patient.</td>
</tr>
<tr>
<td>5</td>
<td>Moribund.</td>
<td>Hypovolaemic shock.</td>
</tr>
<tr>
<td>E</td>
<td>Emergency.</td>
<td>Caesarean section.</td>
</tr>
</tbody>
</table>

ASA grades 3, 4, and 5 denote sick patients.

Table 4. The American Society of Anesthesiologists physical health status classification system.

An understanding of the pathophysiology of the disease process enables appropriate patient management in the perianaesthetic period. Usually, use of appropriate pre-anaesthetic medication and, perhaps, IV co-induction agents is recommended to minimise the doserelated adverse effects of induction and inhalation agents.

Different disease conditions warrant different modes of patient monitoring. For example, an animal with a pre-existing cardiac arrhythmia may benefit from electrocardiographic monitoring during induction, maintenance and recovery from anaesthesia, while arterial blood pressure should be monitored in a patient with chronic renal failure to ensure adequate renal perfusion. Sick patients should be monitored carefully in the recovery period, and supportive measures, such as IVFT and oxygen supplementation, may be required.

Patients with chronic disease are often receiving long-term medication. The pharmacology of these drugs must be understood to avoid drug interactions with anaesthetic and analgesic agents. For example, clomipramine and selegiline can both interact with pethidine and tramadol, since they all interfere with serotonin re-uptake. But most long-term treatments, such as anti-epileptic medication
or endocrine therapy, should be continued as normal prior to anaesthesia. Angiotensin-converting enzyme (ACE) inhibitors cause vasodilation, and their use prior to anaesthesia may result in hypotension, particularly if acepromazine is included in the anaesthetic protocol.

The procedure

Analgesia

Figure 6. A lumbosacral epidural injection.

Good analgesia during a painful procedure results in a more stable plane of anaesthesia and a reduction in the inhalation agent requirement. Any surgery should be considered painful, and procedures such as radiography could be painful if the patient has osteoarthritis or a fracture. Careful positioning may result in a smoother anaesthetic for such animals. For moderately to severely painful procedures in dogs, use of a full \( \mu \) receptor agonist opioid such as pethidine, methadone or morphine may result in better analgesia. This is true for cats, although the partial \( \mu \) agonist buprenorphine has been shown to be a good analgesic in this species (Stanway et al, 2002). NSAIDs should also be administered as part of the pre-anaesthetic medication, unless contra-indicated.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial bolus dose</th>
<th>Infusion dose range</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>1mg/kg.</td>
<td>25ug/kg/minute to 50ug/kg/minute.</td>
<td>Overdose causes muscle twitching and seizures, metabolism depends on adequate hepatic blood flow, use with care in patients with decreased cardiac output, use preservative-free formulation.</td>
</tr>
<tr>
<td>Ketamine</td>
<td>0.5mg/kg.</td>
<td>5ug/kg/minute to 20ug/kg/minute.</td>
<td>Adverse effects (dysphoria) rare at this dose.</td>
</tr>
<tr>
<td>Morphine</td>
<td>0.1mg/kg.</td>
<td>0.1mg/kg/hour to 0.5mg/kg/hour.</td>
<td>May cause respiratory depression if used under anaesthesia, IPPV may be required.</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>1ug/kg to 5ug/kg.</td>
<td>0.2mg/kg/hour to 0.5mg/kg/hour.</td>
<td>May cause respiratory depression if used under anaesthesia, IPPV may be required.</td>
</tr>
</tbody>
</table>

None of these drugs are licensed for this purpose, IPPV = intermittent positive pressure ventilation.

Table 5. Doses used by the author for IV infusion of analgesic drugs during anaesthesia.
For painful procedures, additional analgesic techniques should be included in the protocol for the intra and postoperative periods. These could include local anaesthetic techniques and intravenous infusions of analgesic drugs.

Use of local anaesthetics requires some knowledge of the drugs, including awareness of the potential adverse effects and the toxic dose. However, they are cheap and generally safe when used appropriately. They are the only means available to completely block pain sensation. The complexity of their use can range from a “splash block” of a surgical wound to an epidural injection (Figure 6).

Intravenous infusion of analgesics, such as lidocaine, ketamine, morphine and fentanyl (see Table 5), requires placement of an IV catheter and the use of a syringe driver or volumetric fluid pump for accurate dosing (Figure 7). Opioid infusions may cause respiratory depression during anaesthesia, and intermittent positive pressure ventilation is often required.

![Figure 7. A syringe driver loaded with diluted morphine ready for IV infusion.](image)

Although IV infusions may appear expensive and time consuming, drugs such as ketamine and lidocaine are inexpensive. A bag or syringe containing the analgesic agent can be set up at the start of the day, and providing the IV catheter has an extension set or T port attached to prevent contamination, it can be used throughout the day. A single dose of ketamine (0.5mg/ kg IV) helps with analgesia intraoperatively, and may help prevent central sensitisation.

**Adverse events**
If haemorrhage, hypotension or haemodynamic instability are likely to occur during the procedure, at least one IV catheter should be placed and IV fluids, including colloids, should be readily available.

If severe haemorrhage (greater than about 20 per cent blood volume) is likely, whole blood or packed red cells should be available (Figure 8).

It may be best to avoid acepromazine in this situation, so that the vasoconstrictive response to hypotension is better preserved. If appropriate, NSAIDs should be given at the end of the procedure once the patient is stabilised.
Postoperatively, such animals should be monitored for ongoing blood loss or hypovolaemia by regular checks of heart rate, mucous membrane colour, capillary refill time, pulse quality and, if the index of suspicion is high, packed cell volume and total solids.

**Conclusions**

While use of routine anaesthetic protocols saves time and facilitates preparation for general anaesthesia, attention to the requirements of individual patients is essential to prevent morbidity and mortality (Table 6).

Pharmacological management is only one aspect of the anaesthesia protocol, and an understanding of the potential problems associated with the patient and procedure is more important for patient safety.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Healthy adult</th>
<th>Geriatric</th>
<th>Paediatric</th>
<th>Sick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food withheld.</td>
<td>Six to eight hours.</td>
<td>Six to eight hours.</td>
<td>Three to four hours.</td>
<td>Variable.</td>
</tr>
<tr>
<td>Opioid.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>IV catheter</td>
<td>Yes, for painful procedures, likely blood loss or hypotension.</td>
<td>Yes.</td>
<td>Yes, especially for painful procedures.</td>
<td>Yes, for painful procedures, likely blood loss or hypotension.</td>
</tr>
<tr>
<td>IV fluid therapy.</td>
<td>Yes, depending on procedure.</td>
<td>Yes.</td>
<td>Yes, depending on procedure.</td>
<td>Yes.</td>
</tr>
<tr>
<td>Additional analgesia.</td>
<td>Yes, for painful procedures.</td>
<td>Yes, for painful procedures.</td>
<td>Yes, for painful procedures.</td>
<td>Yes, for painful procedures.</td>
</tr>
</tbody>
</table>

Table 6. Suggestions for anaesthesia protocols for different patients.

**Should the anaesthetic protocol include pre-anaesthetic blood screening?**
There is no evidence to support the use of preanaesthetic blood tests in healthy patients that are undergoing routine procedures (Alef et al, 2008).

History and physical examination are more important than blood tests for pre-anaesthetic assessment of healthy patients. If these indicate the presence of disease, then pre-anaesthetic bloods are warranted.

In sick patients, pre-anaesthetic blood screening has been associated with decreased risk of death, and ASA grade three to five patients that underwent pre-anaesthetic blood tests were more likely to receive pre-anaesthetic IV fluid therapy (Brodbelt, 2006).

Pre-anaesthetic blood tests may flag up abnormalities and enable them to be addressed before the anaesthetic, such as dehydration, electrolyte and glucose abnormalities. This will improve the ability of sick patients to tolerate the adverse effects of anaesthetic agents.

There is also evidence that pre-anaesthetic blood screening may be beneficial in geriatric patients due to a high proportion of undiagnosed diseases being recognised this way, resulting in a change in management (Joubert, 2007).

A pragmatic approach is to perform preanaesthetic blood screening on older patients, such as those more than eight years old, and on sick patients.

Suggested tests are packed cell volume, total solids, electrolytes, glucose, urea and creatinine.

References


**Further Reading**