Anaesthesia

What can we learn from the veterinary literature? Studies investigating adverse events in veterinary anaesthesia are few and far between with most concentrating on fatality, the most obvious and easy to observe outcome. One recent study reported clinically significant adverse events (AE) in 41.2% of 1386 anaesthetics. Clinical significance was defined as events that required intervention by the anaesthetist. The relative frequency of AEs reported were as follows: arousal or breakthrough pain (14.9%), hypoventilation (13.5%), hypotension (10.3%), arrhythmias (5.8%), hyperthermia/hypothermia (5.0%), airway complications (4.8%), recovery excitation (4.6%), aspiration risk (4.5%), desaturation (2.8%), hypertension (1.7%) and 'other' (3.7%). Interestingly, canine anaesthetics (57.3%) were more likely to involve AEs than were feline anaesthetics (35.5%). One explanation for this was that electronic monitoring equipment might function better in larger patients and mean that more borderline shifts in physiological status could be recognised, meaning adverse events were triggered more readily in dogs than in cats. In terms of outcome, fatality was 0.43% (in line with other studies) but, interestingly, in 20% of cases that encountered adverse events there was some sort of impact on the care provided in the post anaesthetic period.

What should we do? We need to understand that, however good we believe our anaesthesia to be, adverse events will happen and that we have at our disposal the means to control them or at least manipulate their course. It is vital we recognise that most adverse events in anaesthesia are predictable and that many are preventable. This lecture will aim to highlight how commonly our patients are put at significant risk under anaesthesia. It will try and help develop skills in assessing at-risk patients and methods that can be used to assist the anaesthetist during an event or crisis.

KEY LEARNING OBJECTIVES

- Appreciate the frequency at which potentially harmful complications occur under anaesthesia
- Learn how to better spot at-risk patients prior to anaesthesia and to recognise adverse events
- Learn methods by which complications can be managed

MULTIPLE CHOICE QUESTIONS

1. When encountering a complication during anaesthesia, what does the 'rule of three' mean?
 - a. If initial interventions are unsuccessful then three diagnostic possibilities should be ruled out before a third intervention is performed
 - b. An intervention should be attempted three times before thinking of an alternative option
 - c. The anaesthetist should close their eyes and take three deep breaths before proceeding
 - d. Physiological parameters should be checked three times before intervening
2. According to a recent study what proportion of anaesthetised small animals required additional monitoring or treatment in an intensive unit?
 - a. 0.01%
 - b. 0.43%
 - c. 2%
 - d. 7%
3. Adverse events resulting in fatality are more likely to occur in which periods of anaesthesia?
 - a. Following premedication and prior to induction
 - b. Maintenance and recovery
 - c. Induction and recovery
 - d. Induction and maintenance
4. According to theoretical analysis of human anaesthesia literature what proportion of adverse events can be identified when using a pulse oximeter, capnograph and blood pressure monitoring?
 - a. 74%
 - b. 87%
 - c. 93%
 - d. 99%
5. Which of these was NOT a risk factor for anaesthetic death identified by CEPsAF?
 - a. Use of intravenous fluids in cats
 - b. Intubation for short procedures in cats
 - c. Worsening health status
 - d. Use of medetomidine as a premedication agent

CRIs: what's available in my practice?

Ian Self

Constant rate infusion (CRI) is a method of delivering a range of intravenous drugs in the perioperative period. These may be specific anaesthetic drugs such as propofol or alfaxalone, analgesic drugs such as methadone or medetomidine, or drugs with other applications such as lidocaine.

In contrast to boluses, a CRI allows more accurate administration of drug over time which can be readily altered according to the clinical effect. When administered as a bolus, a drug may transiently reach levels in the plasma higher than required for a clinical effect, followed by a 'slow

decrease to a point where repeat dosing is required (below the therapeutic concentration). With a CRI, however, it is usually possible to administer just enough drug to maintain a constant therapeutic level, avoiding the potential side effects of large bolus administration. Another advantage is that once the CRI is stopped, plasma drug levels are likely to decrease faster than following a bolus administration; this means that there is better control of the effects of a drug on the body once administration has ceased. CRIs in anaesthetised patients are also used to reduce the dose of inhaled anaesthetic agents (reduced minimum alveolar concentration (MAC)), particularly in patients with poor blood pressure.

There are some disadvantages, however, to the CRI technique; arguably the major disadvantage is the need for serviced and accurate equipment. Some CRI drugs are used at very low doses: a good example would be a postoperative infusion of dexmedetomidine to provide sedation and analgesia. A common dose would be 4 µg/kg/hr, which in a

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20 kg dog would be approximately 0.16 ml/hr if using the 500 µg/ml solution; it is obvious that an accurate syringe driver must be used for such doses even if the drug is diluted prior to use. Another disadvantage is that some drugs accumulate over time. Fentanyl for example shows 'context-sensitive half time', where the longer the drug is infused the longer the effects will take to wear off when the CRI is stopped, irrespective of the dose.

Commonly used CRIs which will be mentioned in this session include:

- Propofol/alfaxalone. Commonly used post induction where it is not possible to use inhaled anaesthetic agents for all or part of a procedure, such as bronchoscopy or certain types of airway surgery. In all cases, however, a patent airway should be secured
- Methadone/morphine/fentanyl. Potent mu-agonist opioids that are used to provide analgesia during major surgical procedures. CRI administration helps to avoid some of the cardiorespiratory depressant effects seen when these drugs are administered as a bolus
- Morphine + lidocaine + ketamine (MLK). A potent and highly effective combination of analgesic agents used for the control of severe pain in the perioperative period. Careful monitoring of patients is required to ensure excess physiological depression does not occur. Very useful for 'breakthrough' pain where opioids alone are ineffective. Not recommended for use in cats
- Lidocaine. Following a bolus administration, is often used for analgesia, MAC reduction and to control certain ventricular arrhythmias. Not recommended for use in cats

KEY LEARNING OBJECTIVES

- Describe the equipment required for CRI administration
- Name examples of drugs suitable for administration as

CRIs to anaesthetised patients

- Compare and contrast CRI with bolus administration of drugs

MULTIPLE CHOICE QUESTIONS

1. What is a constant rate infusion (CRI)?
 - a. Repeated bolus dosing of an opioid
 - b. Constant intravenous infusion of an opioid
 - c. Constant isoflurane concentration delivery
 - d. Multiple subcutaneous injections of an opioid
2. What drug should not be administered to cats as a CRI?
 - a. Fentanyl
 - b. Lidocaine
 - c. Medetomidine
 - d. Alfaxalone
3. What is 'context-sensitive half time' with respect to fentanyl?
 - a. Faster clearance of fentanyl from the body after a long CRI of fentanyl
 - b. Slower clearance of fentanyl from the body after a long CRI of fentanyl
 - c. Reduced efficacy after a long CRI of fentanyl
 - d. Increased efficacy after a long CRI of fentanyl
4. What CRI could be used to provide excellent analgesia for severe pain?
 - a. Medetomidine and propofol
 - b. Medetomidine, alfaxalone and midazolam
 - c. Morphine, lidocaine and ketamine
 - d. Midazolam and propofol
5. What equipment must be used to deliver low-volume CRIs in practice?
 - a. A drip bag with a 20 drop/ml giving set
 - b. A drip bag with a 60 drop/ml (paediatric) giving set
 - c. A calibrated drip pump
 - d. A calibrated syringe driver

Using alpha 2s to your advantage

Tasha McNerney

Many clinics throughout the world use dexmedetomidine for sedation, but did you know that dexmedetomidine is also labelled as an analgesic? This is a fact that often gets overlooked in practice. Dexmedetomidine is the active S-enantiomer of the alpha-2 agonist, medetomidine. Removal of the inactive molecule, levomedetomidine, results in dexmedetomidine being a 'purified' product with increased potency and decreased stress on the liver. Many practices are familiar with dexmedetomidine as an alpha-2 agonist sedative that is reliable, fast-acting and reversible with antipamezole.

Dexmedetomidine's and medetomidine's main effect is to produce sedation with both **somatic** and **visceral** analgesia. Analgesic effects of dexmedetomidine are principally due to spinal antinociception via binding to non-noradrenergic receptors (heteroreceptors) located on the dorsal horn

neurons of the spinal cord. This mechanism of action inhibits the release of norepinephrine (a catecholamine released by the adrenal gland and part of the fight-or-flight response) and therefore prevents transmission of further nerve impulses. This provides both sedation and analgesia.

Dexmedetomidine is also used frequently as an in-hospital constant rate infusion (CRI) for rough recoveries and breakthrough analgesia. Constant rate infusion of low-dose dexmedetomidine (1–2 µg/kg/hr) can be used in patients that are anxious or in severe pain to provide sedation and analgesia. Dexmedetomidine can also be added to a pre-existing opioid infusion for increased sedation and analgesia. Dexmedetomidine has the potential to cause severe bradycardia and hypotension, therefore these patients should be monitored very closely by a dedicated recovery nurse. A loading dose of at least 0.5 µg/kg (0.0005 mg/kg) i.v. dexmedetomidine should precede the initiation of the dexmedetomidine CRI.

Epidural use of dexmedetomidine can enhance the analgesic effects of other agents given epidurally. Besides the previously mentioned action at heterotropic spinal receptors, dexmedetomidine also produces analgesia by stimulation of cholinergic interneurons when given epidurally. It acts synergistically with epidural opioids, improving the quality and

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