

Pharmacology - Intravenous Anesthetic Agents & Dissociatives

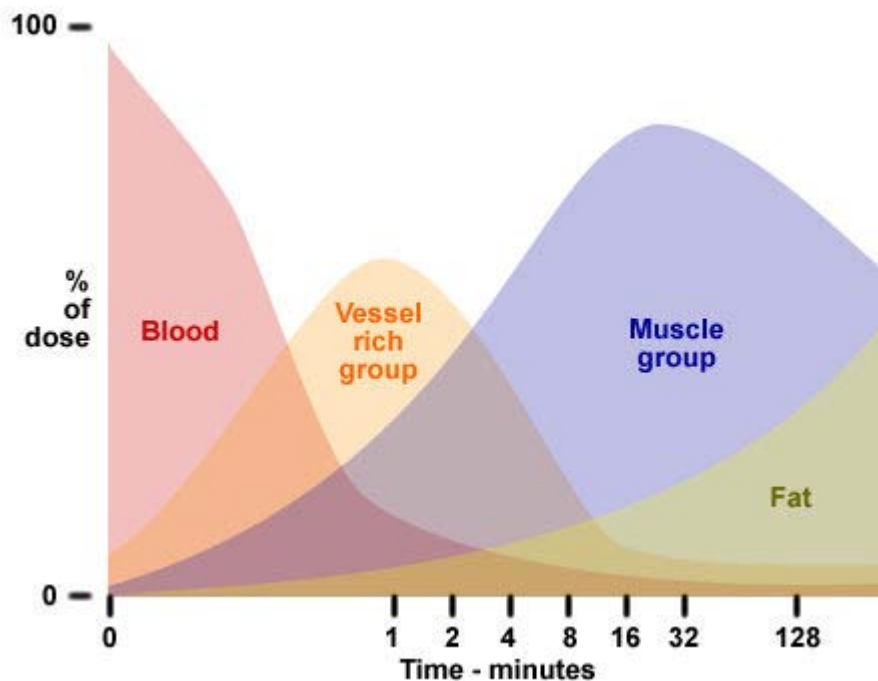
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Introduction

- The term intravenous anesthetic agents implies inducing anesthesia by drugs administered intravenously.
- Advantages of IV anesthesia include rapid and smooth induction of anesthesia, little equipment requirement (syringes, needles, catheters), and easy administration of drugs.
- Disadvantages include difficult retrieval of drug once administered, less control of depth and duration of anesthesia, lack of ventilatory support, and poor tolerability in debilitated, dehydrated or toxicated animals.
- Details of pharmacokinetics and uptake and metabolism of these agents are beyond the scope of this lecture, but note pharmacokinetic knowledge is essential for safe use of these agents.
- Ideal characteristics of IV anesthetics are
 - high therapeutic index
 - no toxic metabolites
 - non-cummulative
 - potent, so small volume is required for anesthetic induction/maintenance
 - long shelf life and resistance to microbial contamination
 - compatible with other dugs
 - quick and smooth induction and recovery
 - reversible with specific antagonist
 - non-allergenic
 - no cardiopulmonary depression
 - independent of liver and kidneys for metabolism and excretion
 - no effect on cerebral blood flow
 - no endocrinologic effect
 - no pain on injection
 - inexpensive
- Response to administration of IV anesthetic induction agents depends on
 - Dose, concentration and speed of administration
 - Blood volume between injection site and brain
 - Ionization
 - Protein binding
 - Redistribution to non nervous tissue
 - Metabolism and excretion of the drug and metabolites
- The following anesthetic agents will be covered in this lecture
 - Barbiturates
 - Oxybarbiturate - pentobarbital and methohexital
 - Thiobarbiturates - thiopental and thiamylal

- Non-barbiturates:
 - ▾ Propofol
 - ▾ Etomidate
 - ▾ Alphaxalone
 - ▾ Propanidid
- Dissociatives:
 - ▾ Ketamine
 - ▾ Tiletamine (in Telazol®)
- Mechanism of action of barbiturates and non-barbiturates intravenous anesthetics is believed to be via CNS depression by modulation of GABA-mediated neurotransmission.

Barbiturates



Distribution of thiopental after single injection

- Barbiturates are classified according to duration of action:
 - Long acting: phenobarbital
 - Short acting: pentobarbital
 - Ultra-short acting: thiopental, thiamylal, methohexital
- Primary factors determining the plasma levels of the barbiturates are dose, concentration and speed of administration, blood volume between injection site and brain, ionization, degree of protein binding, redistribution to non nervous tissue, and metabolism and excretion of the drug and metabolites

- Major clinical properties include good hypnosis, poor to moderate analgesia and dose-related respiratory and cardiovascular depression.
- However, at light levels of anesthesia, cardiovascular depression is minimal unless the patient is hypovolemic.
- There can be marked recovery excitement, but this is reduced or removed by premedication.
- Barbiturates will cross the placenta, and will affect the fetus
- Adult ruminants metabolize barbiturates faster than do cats and dogs. Thus they may be shorter acting and less cumulative in ruminants. Neonates do not have the necessary enzymes, and prolonged effect may be seen. Although theoretically the horse also has the ability to metabolize barbiturates faster than the dog, this is not so in the clinical circumstances, and recovery from cumulative doses of barbiturates may be prolonged and violent.
- Treatment of overdose of barbiturates is IPPV to remove respiratory depression (NB, analeptics do not last as long as the barbiturate) and fluid therapy to increase renal excretion.
- In small animals, general anesthesia is induced by administering part of pre-calculated dose until the desired anesthetic depth (usually just deep enough for endotracheal intubation) is reached - referred to as "titrating to effect".
- All barbiturates are controlled substances and therefore require good record keeping and security as required by the DEA.

Pentobarbital (Saggital®, Nembutal®)

- Controlled substance (Schedule II)
- Anesthetic concentration is 60 mg/ml. (NB euthanasia solutions contain a higher concentration, and various stabilizing agents sometimes cause cardiac arrest).
- No longer used routinely for anesthetic induction due to its prolonged rough recovery.
- Pentobarbital is mainly used for seizure control in the animal.
- Intravenous dose for healthy unpremedicated dogs and cats is 20-30 mg/kg, given to effect. It has a slower onset of action than thiopental (minutes).
- Pentobarbital is metabolized by the liver.
- Administered IV (slow response, give very slowly) or IP (laboratory rodents).
- Intratesticular injection is still used for castrating pigs (the depot of drug is then removed with castration).
- In single stomached animals, full anesthetic doses produce about 1 hour surgical anesthesia, but recovery takes up to 24 hours. Recovery is also violent (dogs howl and paddle) unless premedication is used.
- Small animals become very hypothermic.
- Ruminants, however, recover quietly and very much faster, and the drug still has a place to play in farm animal anesthesia.
- Contraindicated in neonates and animals with liver failure, respiratory disease, porphyria, requiring cesarean section, hypovolemia and emaciation.

Ultra-short acting barbiturates: Thiopental, Thiamylal, Methohexital

- Ultra-short acting barbiturates are often used in the clinic for inducing general anesthesia in both small and large animals.
- Advantages of ultra-short-acting barbiturates for induction of anesthesia:
 - They are the least expensive of the injectable anesthetics.
 - Need no specialized equipment for administration (vs inhalant anesthetics).
 - These drugs have a rapid onset of action, provide a predictable response, and rapid recovery following single dose administration.
- Patients that benefit from thiobarbiturates induction:
 - Patients with raised intracranial pressure - thiobarbiturates decrease intracranial pressure.
 - Patients with seizure history - thiobarbiturates decrease seizure activity.
 - Patients with corneal lacerations or glaucoma - thiobarbiturates decrease intraocular pressure.
 - Patients for examination of laryngeal function - thiobarbiturates does not depress laryngeal reflexes at the light dose.
 - Patients with hyperthyroidism - thiobarbiturates have antithyroid effect.
 - In large animals, ultra-short acting barbiturates are usually used in combination with glycerol guaiacolate (also called 'guaifenesin'). When compared to using ultra-short acting barbiturates alone, the total dose of ultra-short acting barbiturates is decreased when it is given with guaifenesin. This results in less cardiovascular depression and smoother inductions and recoveries from anesthesia.
- Precautions when using ultra-short acting barbiturates for induction of anesthesia:
 - The drug must be given intravenously because of its highly alkaline pH (= 11); perivascular injection will cause tissue necrosis. The drug must not be used when venous access is not possible or questionable.
 - Small margin of safety between an effective dose and a lethal dose - especially in debilitated patients.
 - Apnea and profound respiratory depression following IV bolus injection often occur.
 - Cardiac arrhythmia often presents - ventricular bigeminy and other ventricular arrhythmias (PVCs)
 - Thiobarbiturates should not be used alone in sighthounds (Greyhounds, Whippets, Salukis, Afghan, Borzoia etc.); recovery is 2-4 times longer than in non-Sighthounds, and may be very rough.
 - Methohexital is acceptable for use in Sighthounds; recovery time is not prolonged.
 - Thiobarbiturates induce splenic engorgement, which makes surgical manipulation and removal of the spleen more difficult. Other induction agents should be used in patients requiring a splenectomy.

Thiopental (Thiopentone) (Pentothal®)

- The most widely used barbiturate.
- Presented as powder and dissolved in water to required concentration. Limited shelf life of solution. Only for IV use.
- Very acidic; causes severe necrosis in accidental extra-vascular administration. Inject through catheters to avoid this.
- The lowest concentration practicable should be used (1.25% cats; 2.5% dogs; up to 10 % for large horses and cattle).
- High concentrations cause thrombophlebitis in the vein. Treat accidental extravascular injection by injecting sterile saline with either the enzyme hyaluronidase or local anesthetic without epinephrine. Volumes needed depend on concentration and quantity of thiopental but may be very large (e.g., 500 mls in a horse).
- In most unpremedicated domestic animals, doses of 10 mg/kg thiopental will cause rapid onset and short duration (5 minutes) unconsciousness. However, effect depends on concentration and speed of injection.
- Recovery is by redistribution. Further doses become cumulative; each dose delaying recovery, until at the maximum licensed cumulative dose (30 mg/kg) (NB, anesthetists consider that a cumulative total of 30 mg/kg in single stomached animals is a gross overdose; do not exceed a total dose of 15 mg/kg).
- Recovery is identical to that seen with pentobarbital.
- Respiratory depression is marked, so except at the very lowest doses, oxygen supplementation is needed.
- At 10 mg/kg in the majority of fit animals, there is little cardiovascular depression (although by 30 mg/kg this may be marked).
- Premedication reduces dose (4-8 mg/kg IV in cats or dogs), and increases duration. Acepromazine, opioids, benzodiazepines or alpha 2 agonists decrease thiopental dose in a dose-related manner. Premedication usually results in a smoother recovery.
- Thiopental is highly protein bound; thus hypoproteinemic and anemic animals are very sensitive to its effects (keep doses very low). Similarly hypovolemia increases sensitivity.
- Contraindicated in neonates and animals with liver failure, porphyria and emaciation.

Thiamylal (Surital®)

- Very similar to thiopental and has been widely used until manufacturing ceased in late 90's.

Methohexital (Brietal®)

- Presented in powder and dissolved as required for IV use only.
- Recovery from this ultra-short-acting barbiturate is by redistribution, but it is rapidly metabolized in the liver so is less cumulative than is thiopental.

- It is also less irritant (presumably due to lower concentrations).
- Premedication is essential to avoid a violent recovery.
- Following acepromazine premedication, the induction dose of methohexital in most fit animals is around or below 5 mg/kg.
- Quality of anesthesia is poor with twitches and convulsions seen, unless coupled with deep premedication. Cattle sometimes show "Brietal shakes".
- Tendency to laryngeal spasm in cats and men.
- As main advantage was non-cumulation and rapid recovery, its use is being displaced by propofol except in the large animals.

Phenol derivative

Propofol (Rapinivet®; Diprivan®).

- Propofol (2, 6 diisopropylphenol) is a phenolic compound unrelated to any other general anesthetics.
- Propofol is a non-barbiturate, non-dissociative intravenous anesthetic agent, and very widely used in dogs and cats.
- Propofol is not water soluble, and is prepared as a milky white emulsion of containing 10 mg propofol, 100 mg soybean oil, 12 mg egg lecithin, and 22.5 mg glycerol per ml.
- Propofol contains no preservative and the emulsion supports bacterial growth and endotoxin production. Once exposed to the air the contents in the vial must be used within 8 hours or discarded thereafter.
- New formulation of Propofol resistant to microbial contamination is under current development.
- Propofol is not a controlled substance, a major advantage over other scheduled agents.
- Propofol is for intravenous use only (non irritant, but too rapidly metabolized for other routes).
- Propofol is very respiratory depressant (worse than thiopental).
- Maximal effects are a little slower than a circulation time so beware of delayed respiratory depression about 2 minutes after induction. Some animals become cyanotic without stopping breathing.
- Circulatory effects at equipotent doses are similar to thiopental (some hypotension and direct cardiac depression)
- Muscle relaxation is usually fair.
- Quality of anesthesia (smoothness) is usually good.
- Quality of recovery is usually excellent (very complete).
- Convulsive twitching or muscle rigidity is seen following induction at times but usually resolves spontaneously.
- Propofol is rapidly metabolized by hepatic and extra-hepatic metabolic pathways. Recovery depends on this rather than on redistribution away from highly perfused tissues (eg, brain).

- Propofol is, in general, non cumulative. Thus it can be used for prolonged anesthesia by intermittent injection or by continuous infusion (NB, in neonatal children problems occurred when it was used by continuous infusion for several days to obtain sedation in intensive care. It is probable that the toxicity was due to accumulation of the carrier in patients whose enzymes were sufficiently undeveloped to cope. It can be used safely for anesthesia in neonates).
- Propofol has extensive protein binding over 90 %.
- Propofol should be administered slowly 'titrate to effect' for endotracheal intubation.
- Single induction dose of propofol in healthy non-sighthound dogs makes no clinically significant difference in terms of awakening time from induction to recovery compared to thiobarbiturates anesthesia.
- A distinct difference exists between propofol and thiopental for anesthesia induction. Propofol is more hypnotic, so can be given slowly (over a period of 60 seconds), as subclinical doses of propofol, unlike thiopental, are unlikely to induce excitement. So propofol alone can be given slowly as a sedative at lower doses (0.5- 1 mg/kg). The slow IV administration is also helpful to minimize propofol induced apnea by titrating the dose just enough for intubation. On the other hand, the first half of the calculated doses of thiopental is typically administered relatively fast so as to avoid excitement.
- Since propofol provides no analgesia, a high dose is required (to maintain unconsciousness) when performing painful procedures. These high doses produce apnea and intubation with positive ventilation is required. It is recommended to combine propofol with an analgesic agent (opioids or alpha₂ agonists) for painful procedures.
- Propofol has become very popular, particular following price drop after the patent expiration, for use in dogs and cats, both for induction prior to gaseous anesthesia [NB, may need more volatile agent than after thiopental, and for more prolonged procedures (by intermittent injection or by continuous infusion)].
- Propofol is often used to maintain anesthesia during those procedures where gaseous anesthesia is not possible, eg bronchoscopy, transtracheal aspiration, MRI
- Dose depends on premedication. e.g., in dogs, IV induction dose after no premedication is 6-8mg/kg; after acepromazine 2-4mg/kg; after medetomidine a dose related reduction, so after 40 mcg/kg medetomidine IV doses of propofol of 1 mg/kg are adequate.
- Overdose causes apnea. In dogs, single dose just enough for intubation gives about 10-20 minute recumbency.
- Prolonged anesthesia, using continual injection (constant infusion pump) is commonly used in man, and is practicable in animals. In man, computer programs based on EEG and other physiologic monitoring results may be used to control infusion and maintain a constant depth of anesthesia.

Imiazole anesthesia: Etomidate/Metomidate

Etomidate (Amidate®; Hypnomidate®)

- Etomidate is a carboxylated imidazole derivative
- Etomidate is an intravenous, ultra-short-acting, nonbarbiturate hypnotic drug.
- Etomidate is quite widely used in man as an induction agent and by continuous infusion. In man, the IV induction dose is 0.3mg/kg, but higher dose is needed in dogs and cats (2- 4 mg/kg).
- Prolonged infusion suppresses adrenocortical function.
- A single IV dose also suppresses adrenal steroidogenesis in dogs and cats for several hours, but clinical significance of this is unknown.
- Initial recovery is by redistribution, and the half life is moderate (about 1 hour in man), so there is some cumulative effect.
- Etomidate, then, undergoes rapid hepatic metabolism resulting in rapid recovery and does not accumulate when repeated boluses or an infusion is given.
- Major advantages are minimal cardiopulmonary depression. It produces minimal change in heart rate, mean arterial blood pressure, or myocardial performance.
- The respiratory effects of etomidate are similar to thiopental and propofol - it will induce respiratory depression and apnea in animals.
- Etomidate has not gained popularity as a regular anesthetic induction agent in veterinary medicine because:
 - It is the most expensive (vs propofol and thiopental)
 - Sneezing, retching, and myoclonic twitching are often observed at induction (these side effects can be minimized with a premedication)
 - Etomidate inhibits adrenocortical function
 - Hemolysis and hematuria also have been reported in dogs and cats following either induction or infusion of etomidate
 - It is painful upon injection due to its propylene glycol preparation
- Perivascular injection of etomidate does not cause tissue irritation.

Metomidate (Hypnodil®)

- Metomidate has been used over two decades as a hypnotic agent in the pig.
- Given IV (irritant), its advantages are minimal respiratory or cardiovascular depression with good quality hypnosis.
- Analgesia is very poor.
- Recovery time is of moderate length (about 1 hour).
- It has been withdrawn and is currently not available.

Dissociatives(Phencycline derivatives): Ketamine and Tiletamine

- Dissociative anesthesia implies dissociation from the surrounding with only superficial sleep mediated by interruption of neuronal transmission from unconscious to conscious parts of the brain.
 - During dissociative anesthesia, the animal maintains its pharyngeal, laryngeal, corneal, palpebral, and swallowing reflexes. The eyes also remain open.
 - Dissociative anesthetic agents increase muscle tone, spontaneous involuntary muscle movement (occasionally seizures are seen in some species)
 - Salivation, lacrimation are also increased.
 - Somatic analgesia is good.
- Ketamine and tiletamine (combined with zolazepam in Telazol®) are the two dissociative anesthetics currently available in veterinary practice.
- Cardiovascular effects of dissociatives are dose dependent. At clinical doses, ketamine (and tiletamine) centrally stimulate the sympathetic system resulting in tachycardia, increased blood pressure and increased cardiac output. Large doses of ketamine depress the myocardium directly and may produce hypotension.
- Ketamine and Telazol® produce less respiratory depression than other intravenous anesthetic agents (propofol, etomidate, barbiturates); however, clinically effective dose of ketamine or Telazol® may induce apnea in some susceptible animals.
- In most species, ketamine and Telazol® are metabolized by the liver. In cats, a significant amount (50%) of ketamine is excreted unchanged by the kidney. This difference may account for differing responses seen in dogs and cats receiving dissociatives. Dogs tend to have slow and stormy recoveries (head shaking, salivating, muscle rigidity, vocalization, defecation) from ketamine and Telazol®, while cats tend to have faster and smoother recoveries.
- Both ketamine and Telazol® are control substances (schedule III) and require for accurate documentation and security. ketamine is currently widely abused.
- Ketamine and Telazol® reliably produce anesthesia following either IM or IV administration
- The effectiveness of these drugs following IM administration is an important reason for the popularity of these agents in cats, many exotic species, and intractable patients.

Ketamine

- Ketamine is congener of phencyclidine. It was first used in human anesthesia in 1965 and in veterinary anesthesia in 1970.
- The ketamine molecule exists in two optical isomers.
 - the positive isomer produces more hypnosis and is twice longer lasting than negative isomer
 - the positive isomer produces more analgesia and less hallucination
 - although pure isomer preparation is available, it is the racemic mixture that is typically used for routine clinical purpose.

- Ketamine appears to selectively depress the thalamocortical system, an association region in the cerebral cortex, while stimulating the reticular activating and limbic systems.
- Ketamine should be used cautiously in patients at increased seizure risk.
- Ketamine possesses better somatic analgesia than visceral analgesia.
- Its analgesic effect is partly mediated by N-methyl-D-aspartate (an excitatory neurotransmitter) antagonistic activity.
- In dogs and horses, ketamine should be used in combination with or after premedication (xylazine, detomidine, medetomidine, diazepam, midazolam, and acepromazine) with a sedative or a tranquilizer - violent involuntary movements (muscle rigidity and/or seizures) will occur if ketamine is given alone.
- In dogs, ketamine is often combined with diazepam, midazolam, or medetomidine, whereas as in horses, xylazine or detomidine is used.
- Ketamine has been used in combination with guaifenesin as an induction agent in large animals (horses, cattle).
- Eyes remain wide open with nystagmus at times, and, therefore protective eye lubrication is indicated to protect the damage of the eye during anesthesia.
- Emergence hallucination and delirium can be prevented with concurrent use of sedatives/tranquillizers.
- Increased muscle rigidity is counteracted by use of sedative possessing good muscle relaxant effect (e.g. benzodiazepines)
- Both hypothermia and hyperthermia is observed. Hypothermia is due to its effect on thermoregulatory centers, and hyperthermia on increased muscle activity or hyperactive behavioral change.

Tiletamine (in Telazol®)

- Telazol® consists of equal parts (weight to weight) of tiletamine, a dissociative anesthetic and zolazepam, a benzodiazepine derivative. The pharmacologic actions of these two drugs are complementary with tiletamine providing analgesia and immobilization and zolazepam providing muscle relaxation and tranquilization.
- Telazol® comes as a powder and needs to be re-constituted with 5 ml solution of sterile water or other liquid solution of choice (e.g., ketamine, xylazine). Following reconstitution with sterile water, each ml of solution contains 100 mg of Telazol® (50 mg of tiletamine and 50 mg of zolazepam) per ml.
- Telazol® is a product similar to ketamine and diazepam (Ket-Val) combination.
- In the dog, the plasma half life of zolazepam is 1 hour and that of tiletamine is 1.2 hours. Therefore, the effect of tiletamine outlasts that of zolazepam, and may result in emergence delirium associated with dissociative anesthesia recovery.
- On the other hand, in the cat, the plasma half life of zolazepam is 4.5 hours and that of tiletamine is 2.5 hours. This longer lasting effect of zolazepam over tiletamine may partly explain the smoother recovery characteristics in this species compared to that in the dog.
- Telazol® has been used extensively in exotic large animal (large cats, pigs, and hoof-stock) as a darting agent for immobilization.

Steroid anesthesia

- Historically, hydroxydione and minaxolone were available.
- One of the most widely used steroid anesthetic in current veterinary use in Europe is Saffan® (alphaxalone solubilized by Cemorphor EL). The product is not available in the US.
- There has been a renewed interest in the use of steroid anesthetic with different formulation (alphaxalone solubilized by cyclodextrins) in the US.

Alphaxalone (Saffan®)

- Alphaxalone, a potent steroid anesthetic has been used in veterinary medicine for 30 years in Europe. It is not available in the US for clinical use.
- Alphadolone, a weak steroid anesthetic is added to increase solubility.
- As alphaxalone is poorly water soluble it has been formulated in 20 % polyoxyethylated castor oil (Cremophor EL) and saline (Saffan®) to make 12 mg total steroid per ml.
- It is licensed for use in cats and non-human primates in Europe.
- The agent is metabolized by the liver; non - cumulative.
- Alphaxalone is non-irritant, so can be given IM (volume limited) or IV.
- Respiratory depression is minimal in cats.
- At clinically applicable doses, hypotension is seen through peripheral vasodilation, but cardiac depressant effects is minimal, so circulatory state is well maintained (unless hypovolemic).
- Analgesia is fairly good.
- Quality of anesthesia is good during deep anesthesia, but muscle twitching is seen at light level of anesthesia, with convulsive type behavior in recovery.
- Recovery convulsions are increased by stimulation but can still occur in quiet surroundings.
- IM use can induce twitching during induction.
- Major side effects are swollen ears and paws - this is very frequent although variable in degree. Less frequent occurrence is edema of lungs or larynx (can be fatal). Post-operatively there are occasional reports of ear tips or paw tips sloughing, presumably as a result of swelling.
- More serious side effect can be occasional deaths through post-operative necrosis of larynx.
- Nevertheless, despite these reactions, a mortality report (Clarke and Hall 1991) showed that Saffan® was three times safer in cats than was any other regimens (presumably because of lack of respiratory depression).
- The popularity of Saffan® in the cat is because, without causing apnea, a large enough dose can be given as a single IV bolus to enable an ovariohysterectomy to be performed.
- In the unpremedicated cat IV doses of 9 mg/kg gives 20-30 mins surgical anesthesia (enough for an ovariohysterectomy). Respiration and circulation are well maintained. Top up doses (1-3 mg/kg) can be given to lengthen anesthesia if

required, or volatile agents may be used. Smaller doses may be used for induction only.

- Acepromazine premedication does not reduce the dose but improves quality of anesthesia and reduces paw/ear swellings. Alpha 2 agonists greatly reduce the dose, but must be combined with great care.
- Do not use in dogs! It has not a license in this species in Europe because the Cremophor EL formulation would induce high incidences of allergic reaction in this species, fatal at times. Histamine release causes severe hypotension, broncho-constriction, rashes and vomiting. Although there is a published paper on its use with anti-histamines, the Clarke and Hall report (1991) showed these do not adequately remove the problems, there being frequent histamine like reactions and a death rate of 1 in 100!
- It has been used in a variety of species. Occasional aberrant reactions occur, presumably through histamine release. Large animal use is limited by volume and the poor quality of recovery.
- Non Cremophor EL formulation
 - A 10 mg/ml solution of alphaxalone in 2-hydroxypropyl-beta-cyclodextrin (Alfaxan-CD®; Jurox) has been formulated for use in veterinary patients in Australia, and its use was reported to provide satisfactory intubation condition in pigs (Keates 2003).
 - Since it does not contain Cremophor EL it should be devoid of histamine-releasing activity, and provide less anaphylactoid reaction associated with its use.
 - Circulatory stability is excellent, and the quality of induction and recovery is excellent in dogs using this formulation (Muir, personal communication 2005).

Others

Propanidid (Epontol®)

- Propanidid, a eugenol derivative, is highly water soluble and onset of induction and recovery are rapid, the rapid recovery being due to both redistribution and metabolism.
- This short acting intravenous induction agent was frequently used in human anesthesia in some European countries, but fell into disrepute as it was solubilized in Cremophor EL and has high incidence of allergic reactions. The Cremophor preparation has been withdrawn worldwide. It is currently undergoing new trials with a different formulation in human. The future of its use in veterinary medicine is uncertain at this point, and will largely depend on its success in human anesthesia.

Opioid/Benzodiazepine combination as neuroleptanalgesia induction technique

- In man, high dose potent opioids may be used in combination with sedatives (usually midazolam) to produce anesthesia induction or total intravenous anesthesia (neuroleptanalgesia).
- The combination is popular for anesthesia induction or intra-operative supplementary anesthetic administration (so as to reduce volatile dose) in sick animals due to good cardiovascular stability.

Total intravenous anesthesia (TIVA)

- Recent developments in human anesthesia have concentrated on attempts to maintain a total intravenous anesthetic (to avoid disadvantages of volatile anesthetics; see inhalation anesthesia).
- The progression has included the use of EEG/computer controlled programs of administration. Propofol, midazolam and opioids are the mainstay drugs used for this in man.
- All of these may be used in dogs, but (although under further investigation) have limitations in horses.
- Current veterinary work in large animals concentrates on the use of ketamine, guaifenesin, alpha 2 agonists, barbiturates and choral hydrate.
- Despite the explosion of experimental and clinical trials as there are many limitations in TIVA for routine clinical application so it is unlikely that the TIVA will replace inhalation anesthesia both in human and veterinary anesthesia for considerable time to come.

Clinical notes

- Several choices are available in the selection of agents used for anesthetic induction
- Physical condition of the patients should be considered as top priority followed by economic and other logistic concerns in the choice of an anesthetic induction agent.
- It must be remembered there is no ideal anesthetic induction agent that is completely devoid of side effects, and it is the anesthetist that makes the use of the drug safe.