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Anaesthesia Refresher and Update for Veterinary Nurses Mini Series

Session Two: Preparation for Anaesthesia, Induction and Maintenance

Denise Prisk DipAVN Surgical VTS Anesthesia and Analgesia

CPD SOLUTIONS – ANAESTHESIA REFRESHER AND UPDATE FOR VETERINARY NURSES
MODULE 2: PREPARATION, INDUCTION AND MAINTENANCE

PART 1: PREPARATION FOR ANAESTHESIA

Thorough preparation of all equipment, drugs and of the patient itself is an essential phase in the preanaesthetic period. Lack of preparation increases the morbidity and mortality rate. A full history must be obtained from the owner when the patient is admitted to the practice and all relevant information should be recorded on the admission sheet and the patient's hospitalisation record. Informed consent for anaesthesia and any procedures is obtained. At the time of admission, an identification collar should be attached to the patient, ideally in the presence of the owner or person presenting the animal for anaesthesia.

Certain information should be obtained from the owner before they leave the practice. This includes the time that the patient last ate solid food. Optimal food deprivation times remain controversial, and different studies have yielded different results. For dogs and cats, it is desirable that they have been starved of food for 6-8 hours as regurgitation under anaesthesia can lead to aspiration and its consequences. In all likelihood, many patients presented for routine, elective procedures will have been starved for around 10-12 hours by the time of anaesthesia. Water is generally left available until 1-2 hours before induction of anaesthesia.

Starvation times for small mammals and birds vary. Although rabbits cannot vomit, due to their tight lower oesophageal sphincter, it is often advised that pellet and fresh food items are removed approximately one hour before anaesthesia, so the pressure of a full stomach on the diaphragm is reduced, which will help their breathing. Also, recent ingestion of food sometimes results in residual food in the oropharynx and glottis, which means intubation cannot take place safely. Hay and water are left available until the rabbit is sedated.

A thorough assessment of the patient should be performed in all animals that are to undergo sedation or anaesthesia, and no drugs should be given until this has been carried out.

An accurate weight, using suitable scales (dog or cat scales) must be obtained on the day of anaesthesia. This is especially important for animals that have been hospitalised prior to anaesthesia, as the weight is likely to have changed since the time of admission. Scales that are calibrated in grams are often used for small mammals and exotic pets. Drug doses can then be accurately assessed, as can fluid rates and gas flow rates.

The cardiovascular system is assessed by chest and lung auscultation. Although the veterinary surgeon will perform this assessment, it will likely be the veterinary nurse who is monitoring the anaesthetic, and therefore it is beneficial that the nurse also auscultate the chest and lungs so they know the sounds in the conscious patient and can then establish changes that occur during anaesthesia. Heart murmurs can also be detected, as can abnormal lung sounds. The resting heart and respiratory rates should be obtained and recorded. The rate, strength and character of the pulse gives useful information, as does the rate and character of respiratory movements and sounds, especially in brachycephalic dogs or any patient with airway disease. It is also very useful to know the conscious saturation of haemoglobin with oxygen (SpO_2) in brachycephalic dogs, as it is likely to be around 95-96%. At the end of anaesthesia, when reacclimatising them to room air, it may be that an SpO_2 of higher than 96% cannot be obtained, even though it has been higher during anaesthesia.

Assessment of the mucous membranes is performed, noting the colour and capillary refill time. It is important to palpate the peripheral pulses in the conscious patient so changes under anaesthesia can be detected. Temperature, pulse and respiratory rates should be obtained as baseline values, prior to sedation.

Hydration status should be normal and if not, it should be corrected before anaesthesia. It is not usual to perform laboratory tests on all patients undergoing anaesthesia, and for the majority of cases, the anaesthetic plan will not be changed because of laboratory results. If results of physical examination suggest any abnormalities that may compromise the anaesthetised patient, blood analysis should be recommended before any drugs are given or any plan made.

Liver and kidney function are important in the metabolism and elimination of drugs, and to maintain fluid and electrolyte balance. The health of these organs can be assessed using haematology and biochemistry tests. Common tests in a preanaesthetic profile include ALT (alanine aminotransferase), ALKP (alkaline phosphatase), albumin, urea, creatinine, bilirubin, cholesterol, total protein, blood glucose and packed cell volume and/or haematocrit, together with electrolyte analysis.

For owners who cannot afford expensive laboratory tests, a cheaper alternative is to perform urinalysis (specific gravity to assess hydration) and to take one blood sample for packed cell volume and total protein testing (also assesses hydration status). Blood glucose testing can easily be performed using a glucometer.

An intravenous catheter will ideally be placed in all patients that are to be sedated or anaesthetised. A closed system is maintained with the use of a T or Y-connector, or injection bung. This ensures there is IV access in case of emergency, as there is no such thing as a safe anaesthetic. Induction drugs are also easier to give via a catheter, and control of administration is facilitated. In addition, the infusion of intravenous fluids is possible. If the patient allows, the IV catheter should be placed before any drugs are given. This also enables premedication drugs to be administered intravenously, thereby avoiding painful intramuscular injections. However, this is not always possible, for example, in stressed or very aggressive patients. In this case, intramuscular sedation is usually necessary first, then the catheter placed in the sedated patient. For anxious, stressed and very young patients, the area of skin over the intended location of the catheter can first be numbed, either using EMLA local anaesthetic cream, or using EthyCalm spray. When using EMLA cream, it should be applied liberally, covered with an occlusive dressing such as Clingfilm, and left for 60 minutes. EthyCalm spray works almost immediately but only lasts until the skin temperature warms up – usually only a few minutes.

It is optimal that all patients undergoing anaesthesia are in the best body condition possible, although this may not be achievable for emergency cases. Intravenous fluid infusion, antibiotic therapy, analgesia, correction of inappropriate body temperature and the inhalation of pure oxygen all contribute to preanaesthetic stabilisation.

Once a full patient assessment has been undertaken, an ASA (American Society of Anesthesiologists) physical status classification group is assigned and an anaesthetic plan can be made. Although most general practices will have certain protocols, with regard to premedication, induction, analgesia and fluid therapy, it is best practice for each patient to have its own plan, especially where abnormalities exist, such as the presence of a heart murmur, or compromised liver and kidney function. It is important that potential complications are identified and suitable interventions discussed and agreed with the veterinary surgeon. For many patients and procedures, such complications will be similar, for example, hypotension, hypothermia and pain. If interventions have been previously agreed, time can be saved should a complication arise, and treatment instigated without delay.

The ASA physical status classification is a means of assessing the fitness of patients prior to surgery. Originally designed for human anaesthesia, the veterinary adaptation is used for classifying dogs and cats. There are five categories, based on the physical status of the patient. Other factors exist, such as the drugs used, the nature of the surgery and the skill of the surgeon, all of which may affect patient outcome. However, these are not considered when assigning an ASA category.

ASA Physical Status Classification

I
Normal healthy (non-brachycephalic) patient
Any non-brachycephalic healthy patient with no underlying disease

II
Patient with mild systemic disease (animal compensating well)
Compensated heart disease, healthy paediatric (more than 12 weeks of age) or geriatric patient, obesity, brachycephalic considered healthy

III
Patient with severe systemic disease (animal not compensating fully)
Moderate anaemia, moderate dehydration, pyrexia, healthy neonatal patient (less than 12 weeks of age), brachycephalic with mild respiratory/GI signs

IV
Patient with severe systemic disease that is a constant threat to life
Severe dehydration, uraemia, toxaemia, decompensated heart disease, DKA, brachycephalic with moderate/severe respiratory/GI signs

V
Moribund patient who is not expected to survive without the operation
Severe trauma, decompensated shock, GDV, MODS (multiple organ dysfunction syndrome), major head injury

The letter E for Emergency may be assigned to any grade, when a delay in treatment would lead to a significant increase in the threat to life or body part.

Safety checklists

The World Health Organisation instigated the use of safety checklists in 2008, with the intent of reducing errors. The reduction in errors is well documented and checklists are now commonplace in most practices. A checklist is a list of tasks that must be completed or questions that must be answered before any procedure is performed on the patient. It is important that the checklist is relevant to individual practices, and they will vary, according to the equipment used and the types of procedures performed. They must be user-friendly and easy to complete. It is crucial that all staff involved in anaesthesia use the checklists. Implementing them may take some time, but the aim should be that a checklist is completed prior to every anaesthetic for every patient. Patient risks are identified, and plans can be made to minimise such risks. Checklists are also useful in identifying human error, for example, a closed APL valve after checking the anaesthetic breathing system, or a leaking cuff of an endotracheal tube. Drug calculations should be checked by a person who is different from that person who performed the original calculation and drew up the drug, and this can also form part of the checklist. A veterinary study (Hofmeister et al, 2014) showed that the use of a simple checklist and protocols with interventions significantly reduced (by more than 50%) human errors, including closed APL valves, oesophageal intubation and medication errors, thereby improving patient safety.

Ensuring the correct patient is presented is also a vital piece of information, especially where there are two similar patients in the practice. Information written on the identity collar is checked before any drugs are administered, and before anaesthesia is induced. As well as anaesthesia safety checklists, separate checklists may be used, for example, a surgical procedures checklist, to ensure the correct procedure is performed on the correct body part. It is also a good idea to have a brachycephalic anaesthesia checklist, as their requirements are specific and additional equipment is often needed.

Monitoring machines should be turned on and allowed to warm up, if necessary, so they will be ready to use as soon as the patient is connected.

Often, three sizes of endotracheal tubes are selected and prepared for each patient. It is very difficult to gauge the size of the trachea for many patients, and some, such as brachycephalic dogs, present specific challenges and they have a much smaller trachea than their head size suggests. They are also difficult to intubate, due to their anatomical conformation, and it may be that a very small tube only can be placed. For these breeds, a large selection of ET tubes should be ready to save time during intubation when the patient can desaturate and become hypoxic.

All equipment must be prepared and checked before every anaesthetic – this will be identified on the checklist. In general, the following equipment will be necessary:

- Premedication drugs
- Induction drugs
- Flush solution
- Suitable breathing system
- Range of endotracheal tubes and stylets
- Long tie to hold the jaw open and tie the ET tube in position
- Lubricant for the ET tube
- Intubeaze for cats
- Laryngoscope with a good light and suitable blade
- Syringe to inflate the cuff of the ET tube
- Blanket or warming device
- Monitoring equipment

Premedication

Premedication drugs are administered soon before anaesthesia is induced. The CEPSAF (Confidential Enquiry in Perioperative Small Animal Fatalities) report showed that the use of preanaesthetic medication was associated with a decreased risk of death. The aims are to provide a sedate or calm patient that is stress-free, thereby stabilising the cardiovascular system; to provide analgesia; to decrease anaesthetic agent requirement; and to facilitate a smooth recovery. If an intravenous catheter is already in place, premedication drugs can be given intravenously. Anaesthesia can then be induced after approximately 5-10 minutes. Alternatively, the drugs may be given intramuscularly and anaesthesia induced around 20-60 minutes later. It is important to ensure that anaesthesia is not delayed or that premedication is not given too soon, if the intramuscular route is to be used, otherwise the effects of the drugs are active for a prolonged time and it may be that their effects have worn off by the time of induction. As soon as any drug is given, careful monitoring of the patient is necessary. Depending on the drugs used, there will be various effects, including decreased body temperature and blood pressure. It may be necessary to supply additional warmth to prevent hypothermia before anaesthesia is induced. As premedication drugs are likely to affect the cardiovascular and pulmonary systems, it is good practice to monitor temperature, pulse and respiratory rates after their administration.

In some instances, premedication may not be given. Neonatal animals are not sedated, and paediatrics are only sedated if absolutely necessary. Benzodiazepine drugs can cause sedation in young animals. Bitches and queens presented for caesarean section are also often not premedicated at all. Other groups include very sick animals or those presented as an emergency.

If the risk of regurgitation is increased, as in brachycephalic dog breeds, a proton pump inhibitor drug such as omeprazole may be given pre-emptively, with or without metoclopramide.

Preoxygenation

It is gold standard to give oxygen to all patients before inducing anaesthesia. This maximises tissue perfusion and prevents hypoxaemia occurring during induction. It also increases the Safe Apnoea Period – the time it takes for an animal to become hypoxaemic after apnoea sets in. It has been proven that preoxygenation for 3 minutes, using a tight-fitting mask and an oxygen flow rate of 100 ml/kg/min, delays the time to desaturation from one minute (in non-preoxygenated patients) to around 5 minutes. If the patient is well sedated, it should be possible to use a mask.

However, if the mask causes stress or anxiety, oxygen can be given using the flow-by method. A higher flow rate will be needed and the concentration of oxygen inspired (FIO_2) will be lower than that achieved with a mask.

PART 2: INDUCTION AND MAINTENANCE OF ANAESTHESIA

Induction

Consideration must be given to the environment in which anaesthesia is to be induced. Stress must be avoided for all patients, to reduce the production of stress hormones and catecholamines such as adrenaline. Should the animal become stressed and release adrenaline, the physiological effects, such as increased heart rate, blood pressure and oxygen consumption, have a direct effect on anaesthetic induction. In addition, adrenaline sensitises the heart to arrhythmias. Stress can also increase the risk of regurgitation. This phase of anaesthesia will ideally be as calm and smooth as possible. If there is not a separate induction area, the passing through of staff traffic should be kept to a minimum, and dogs and cats should ideally not be in the same room during induction.

If the patient is well sedated, it will be possible to attach some monitoring equipment before anaesthesia is induced. It is especially useful to attach the ECG if possible, as cardiac arrhythmias may be detected whilst the patient is conscious. However, if placing the ECG electrodes causes stress, it will not be possible.

The inflated cuffs of the endotracheal tubes are deflated prior to induction. The safety checklist is usually completed immediately prior to premedication and induction.

The animal should be positioned in sternal recumbency during induction. This allows both lungs to oxygenate equally and also reduces the risk of aspiration, should regurgitation occur. Preoxygenation, using flow-by oxygen, should continue during induction wherever possible. Intravenous administration of the injectable agent is best accomplished through a previously placed intravenous catheter. If there is a T or Y-connector attached to the catheter, the volume of drug in the tubing should be taken into consideration, especially for small patients whose volume requirements will be less. Induction of elderly patients is likely to take longer, due to their reduced neurotransmitter activity, resulting in a longer time for the drug to reach the brain and the effects to be exerted. Slow administration of the drug is necessary, to avoid overdose. When a co-inductor agent such as midazolam is used, the volume of the main induction agent will be much reduced. This synergistic technique has the benefit of fewer side effects from the induction agent, as less of it is used. As consciousness is lost, the person restraining the patient should maintain it in sternal recumbency and keep the head raised. Regurgitation can occur in any sedated or anaesthetised patient, regardless of the food-withholding period. This is because many drugs reduce the tone of the lower oesophageal sphincter (the sphincter, previously called the cardiac sphincter, that is located at the distal end of the oesophagus and which prevents reflux of gastric contents).

Some patients are more prone to regurgitation than others:

- Brachycephalic breeds, due to the anatomical and functional gastrointestinal tract abnormalities, coupled with their propensity for hiatal hernia. Oesophageal deviation and gastric abnormalities seen in brachycephalic dogs exacerbate the condition.
- Neonatal and paediatric patients, as the lower oesophageal sphincter may not be fully mature.
- Pregnant patients, due to increased intragastric pressure from the uterus, delayed gastric emptying and decreased GI motility. The increased production of the hormone gastrin (which stimulates the production of gastric acid) also means that gastric secretions are more acidic, so if regurgitation and aspiration occur, the potential for lung damage from the acidity is increased. Pulmonary acid aspiration syndrome is a recognised condition in pregnant women, with a similar condition occurring in pregnant animals, with potentially fatal consequences.
- GDV patients or any with a large, space-occupying abdominal mass.
- Some disease conditions, such as diabetes mellitus, where hyperglycaemia can damage nerves that control the passage of food through the stomach to the intestines. Delayed gastric emptying occurs in diabetic patients, and this increases the risk of regurgitation and aspiration.

- Diaphragmatic rupture (trauma) or hernia (congenital), due to the abnormal position of the stomach. Aspiration of gastric acid into already damaged lungs increases the risk of mortality.
- Large dogs, weighing over 40 kg, have been shown to be at increased risk of regurgitation when anaesthetised.
- Obesity, due to the pressure of excess fat on the stomach, and delayed gastric emptying.

Intubation

All anaesthetised patients should be intubated, regardless of whether or not any inhalant agent is to be administered. It is crucial that a patent airway is maintained and that the airway is protected from aspiration. The placement of an appropriate size endotracheal tube allows IPPV (intermittent positive pressure ventilation), the administration of inhalant gases, the emergency administration of oxygen and it also reduces anatomical dead space.

The plane of anaesthesia must be adequate before intubation is attempted, otherwise the risks of gagging, regurgitation, damage and oedema to laryngeal structures are increased. Cranial nerve reflexes are assessed to ascertain whether intubation can be attempted or not. The person restraining the patient opens the mouth and a long tie is used to hold the upper jaw. This is better practice than placing fingers in the mouth. Before attempting to pass a tube, the person intubating has a look at the larynx with a laryngoscope, as this enables better estimation of the correct tube size to place. The optimal length of the tube can be measured against the patient, and is from the incisor arcade to the point of the shoulder. Protrusion beyond the incisors adds to mechanical dead space, but insertion further into the trachea will result in intubation of one bronchus only and therefore oxygenation of only one lung. If the diameter is correct but the tube is too long, it should be cut to an appropriate length. The diameter is important as there will be increased resistance to breathing if the tube is too small. There may also be gas leakage around the tube, which is a health and safety hazard for personnel. The temptation to overinflate the cuff of a tube that is essentially too small must be overcome, and a bigger size placed, otherwise tracheal damage and possibly rupture can ensue. If the tube is too big, it must not be forced and a smaller one placed, as again, tracheal damage is likely.

The larynx of cats is very sensitive and can be easily damaged with mechanical stimulation. The act of intubation in cats can bring about laryngospasm. This is involuntary spasm and closure of the vocal cords, leading to loss of airway, which may be partial or complete. The larynx in this species is therefore desensitised with one spray of lidocaine (Intubeaze), to prevent laryngospasm. Intubeaze in the UK is presented in a spray bottle as a 2% solution. This means the concentration is 20 mg/ml. One spray delivers 0.1-0.2 ml lidocaine, which is absorbed systemically. The dose is 1-2 mg/kg (which equates to 0.05 ml/kg). Therefore, for a 3 kg cat at a dose rate of 1 mg/kg: 3÷20 = 0.15 ml (or 3 x 0.05 = 0.15 ml), meaning that one spray is sufficient. Other applications or administration of local anaesthetic agents that are planned should be taken into account, as the effects of lidocaine are cumulative and it may be that the toxic dose is reached by excess sprays to the larynx during intubation. Priming the nozzle first will help direct the drug to the correct area and avoid an overdose being administered. It is also necessary to allow sufficient time – 60 seconds – for the lidocaine to exert its effects. During this time, flow-by oxygen is given and the induction agent topped up if necessary. Attempting to intubate any patient that is not sufficiently anaesthetised is poor practice as it can lead to gagging, increased risk of regurgitation, postoperative oedema and laryngospasm. When the plane of anaesthesia is sufficient, a laryngoscope with a suitable shape and length of blade is used to visualise the oropharynx. The straight Miller blade is most often used. However, the curved Macintosh laryngoscope blade is sometimes preferred for brachycephalic and other short-muzzled dogs, as there is better visualisation of the larynx.

The tube should first be lubricated before insertion. A water-based lubricant is best. Studies have shown that the pharyngeal seal is better with lubricated tubes that non-lubricated tubes, thereby reducing the risk of aspiration. In addition, irritation and inflammation of the laryngeal structures is likely to be less if the tube has been lubricated. The laryngoscope blade acts as a tongue depressor. The tip of the endotracheal tube can be used to move the epiglottis out of the way, then the tube gently inserted. Placement during inhalation is preferable, when the airway is open and largest. The bevel of the tube is kept ventral and rotating the tip can help guide it into the trachea if necessary. If several attempts at intubation are required, flow-by oxygen should be given between attempts (and ideally during intubation also), and the induction agent topped up to ensure anaesthesia depth is sufficient. The patient will often cough when the tube is correctly inserted.

Capnography is used to establish correct position of the tube. If there is any doubt as to its position, or if capnography is not available, a laryngoscope is used to look directly at the placement and position. Other methods are not recommended. The tube is then ideally tied behind the ears, rather than over the nose, as this can compress nerves and blood vessels. The patient is then connected to the breathing system, whilst oxygen is flowing. The head is still maintained in a raised position and the inhalant agent is not yet turned on. The minimal occlusive volume technique is a recommended way of establishing a pharyngeal seal and inflating the cuff safely. One person with a cuff inflator listens at the mouth for a leak while another person closes the valve of the breathing system and gently inflates and holds the inflated bag. The cuff is inflated until no leak can be detected. If a significant volume of air has been used to inflate the cuff, the tube is too small and a larger one should be placed. Once the cuff has been inflated, the head can be lowered and the anaesthetic depth assessed, before turning on the vaporiser and administering anaesthetic gas. The eyes are then lubricated and monitoring attachments and intravenous fluids connected. Records should be made of the amount of induction agent that was given, the time of administration and the size of endotracheal tube placed. It is also good practice to record the amount of air used to inflate the cuff.

If an endotracheal tube is not placed, a supraglottic airway device, or laryngeal mask airway (v-gel) may be used instead. These are available for rabbits, cats and dogs. They are quick and easy to place, although capnography is desirable to confirm correct placement. They are not suitable for all types of procedure, such as dental procedures and other surgery where access to the head and mouth are required.

Following induction of anaesthesia, the corneas should be lubricated and the time noted on the anaesthetic record. Repeat lubrication is often advised after 90 minutes, or sooner in brachycephalic breeds. It is sometimes helpful to tape the eyes closed to protect them, especially in breeds with protruding eyes, and where there is the potential for damage from air and water, as in the use of a Bair Hugger over the head or in dental procedures.

An anaesthetic chamber may be used to induce anaesthesia in small mammals and exotic species. The larger the chamber, the longer it will take to fill with gas, and the higher the flow rate that will be needed. If there is a partition that can be used for smaller patients, this will be very useful, as long as the anaesthetic inlet and scavenge outlet are on the same side of the chamber. The way in which the tubes are placed is important. Anaesthetic vapour is denser than air, so to achieve induction in a timely manner, the anaesthetic gas should be introduced at the bottom of the chamber and scavenged from the top. The patient should be visible at all times whilst in the chamber. Preoxygenation is essential, to avoid desaturation and hypoxia from breath holding, which is common when inducing anaesthesia in this way. Ideally, pure oxygen should be administered for five minutes before the anaesthetic gas is introduced. When the lid of the chamber is opened, gas is allowed to escape. Therefore, the health and safety risk to personnel of exposure to anaesthetic gas must be considered.

Induction of anaesthesia in dogs and cats should not be accomplished by using inhalant techniques as it is associated with higher mortality rates (CEPSAF report).

Maintenance

Anaesthesia is usually maintained with isoflurane or sevoflurane, vaporised in oxygen, with or without another carrier gas (medical air or nitrous oxide). Immediately after intubation, each patient should be assessed individually, and the vaporiser and fresh gas flow set accordingly, rather than always giving 2% inhalant agent and 2 litres per minute of oxygen.

Moving the patient into the required position for clipping or for the procedure should be done slowly and carefully. It is possible to bring about cardiovascular changes, such as decrease in heart rate and blood pressure, if rapid movements are made, especially when changing from one recumbency to another.

The calculated fresh gas flow for the breathing system is set, or the FGF is set according to inspiratory carbon dioxide readings on capnography (should be 0 mmHg or close to 0). When using a circle circuit, a higher flow is needed at the beginning and end of anaesthesia. Usually 2 L/min is sufficient for the first 10 minutes, then the flow can be turned down and the valve partially closed.

When using a non-rebreathing system, the fresh gas flow set at the beginning of anaesthesia probably exceeds that which is needed as the patient becomes more deeply anaesthetised and the respiratory rate decreases. It should be recalculated when the respiratory rate slows, or every 30 minutes during anaesthesia. It is good practice to check the cuff of the endotracheal tube 10 and 30 minutes after intubation, as reinflation may be necessary. This is because leaks can develop due to softening of the cuff and relaxation of the tracheal muscles.

The patient must be at an adequate plane of anaesthesia before the surgeon makes any surgical incision or performs any painful procedures. Similarly, for surgical procedures, skin sutures are painful and the depth of anaesthesia should not be reduced too quickly towards the end of the procedure.

Stages and planes of anaesthesia are largely not referred to any more, as it is not necessary to have a patient in a certain plane of anaesthesia in order to perform surgery. This is because multimodal analgesic techniques are used, meaning that the plane of anaesthesia can be kept light for even invasive and painful surgeries.

A brief summary of the signs and stages of anaesthesia is shown in the table below. However, it must be noted that consideration is given to drugs that have been administered, as these can affect certain reflexes, such as pupil size and position. Classically, ketamine and atropine cause mydriasis (dilated pupils) and opioids cause mydriasis in cats and miosis (constricted pupils) in dogs.

	Reflex			
Stage	**Jaw**	**Pedal**	**Palpebral**	**Pupil**
I Voluntary excitement	*CONSCIOUS*			
II Involuntary excitement Unconscious	*Tense*	*Strong*	*Strong*	*Central* *Constricted*
III – Plane 1 – Plane 2 – Plane 3	*Relaxed* *None* *None*	*No* *No* *No*	*Slight* *No* *No*	*Downwards* *Upwards* *Almost central*
IV Overdose/coma	*None*	*No*	*No*	*Central* *Dilated*

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Safety checklists can be downloaded at:

https://ava.eu.com/resources/checklists/

www.alfaxan.co.uk/resources