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When Things Go Wrong - Anaesthetic Complications and Emergencies Mini Series

Session One: Proper Prevention Prevents Poor Performance

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Proper Preparation Prevents Poor Performance

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Most anaesthetic drugs commonly used cause some degree of reduction in cardiac output, blood pressure, respiratory rate, tidal volume and body temperature regulation. So it is perhaps surprising that anaesthetic accidents and emergencies do not occur more commonly.
The aim of every anaesthetic is to provide balanced anaesthesia for the patient using a multimodal approach whilst maximising patient safety. Every anaesthetic has the potential to cause harm if not adequately prepared for and then carefully monitored. It is the proper preparation of the patient, drugs and anaesthetic equipment that prevents problems occurring.

Why do we need to be more prepared? – To prevent anaesthesic complications and emergencies!

CEPSAF (The Confidential Enquiry into Perioperative Small Animal Fatalities)
This study looked at anaesthesia related fatalities in a mixture of general and referral practices to assess the mortality rate in our small animal patients, whether this mortality rate was improving and looked at different variables and their effect on anaesthesia related death.
The anaesthesia related mortality rates found in the study were:

- 0.17% in dogs (≈ 1 in 600)
- 0.24% in cats (≈ 1 in 400)
- 1.39% in rabbits (≈ 1 in 70!)

This compares to a rate of 0.2-0.005% in people! So from this we can see that our mortality rates are significantly higher than that of human anaesthesia.

Species	Health Status	Risk of Anaesthetic Related Death
Dog	Healthy ASA 1-2	0.05% (≈ 1 in 2000)
	Sick ASA 3-5	1.33% (≈ 1 in 75)
Cat	Healthy ASA 1-2	0.11% (≈ 1 in 1000)
	Sick ASA 3-5	1.40% (≈ 1 in 70)

This table shows that our higher risk ASA 3-5 patients have a greater than ten times likelihood of dying during anaesthesia or within 48 hours of induction.

	Dogs	Cats	Rabbits
After Premed	1%	1%	0
Induction	6%	8%	6%
Maintenance	46%	30%	30%
Post-operative	47%	61%	64%

This shows table shows that the majority of deaths occurred postoperatively in all 3 species with a large proportion also occurring during the maintenance phase. Problems during maintenance could easily influence the recovery. Awareness of the risk during recovery must increase if we are to reduce the anaesthetic mortality rate. Recovery is often the time when monitoring ceases and thoughts turn to the next anaesthetic but we must plan for recovery and its problems and complications as vigilantly as we prepare for the anaesthetic itself!

What else did we learn from CEPSAF?

- ↑ patient age & ↓ patient weight ↑ risk
- ET intubation in cats undergoing short procedures ↑ risk
    - Greater care when intubating cats
    - Better education at vet school level?
- Fluids increased the risk in cats
    - More care required when administering fluids to cats

    - Accurate rate of administration important (use burettes or fluid pumps/syringe drivers)
- Pulse monitoring & $SpO_2 \downarrow$ risk
- Procedural factors – complexity, duration & urgency more important than drug factors!

Clinical Examination and History

All patients admitted for anaesthesia should have undergone a thorough clinical examination and have a full and complete medical history including any current drug therapies. During our appraisal of the patient's clinical notes it is important to ascertain that a signed consent form for anaesthesia has been obtained. Following these we can evaluate patient pre-existing conditions and risk factors prior to them being anaesthetised for example brachycephalic obstructive airway syndrome, heart murmur, electrolyte imbalances, endocrine diseases, neuromuscular diseases etc. Knowing that the patient is receiving drug therapy is important so that we can evaluate known drug interactions, effects on anaesthesia and prevent overdose e.g. if the patient is already receiving oral non-steroidal anti-inflammatory drugs for another concurrent condition then we should highlight this to prevent an additional dose being administered. It is also prudent to pay attention to the results of any tests that have been performed i.e. blood tests, ultrasound, radiographs which might highlight problems that are not immediately obvious from the patients presenting history. *Pre-operative blood screening is probably not justified in healthy patients under the age of about 8yo as results rarely change anaesthetic plans based on thorough clinical examination and historical assessment (Alef, 2008). Blood screening may be more useful in older geriatric patients even if they appear to be healthy due to an increased incidence of underlying disease.*

All of these things allow us to identify how problems may occur during the anaesthetic process and plan accordingly to allow for or prevent them e.g. the brachycephalic patient e.g. the pug or bulldog may be more difficult to intubate and will require pre-oxygenation, the patient admitted with a known history of diabetes mellitus will require regular blood glucose checks during anaesthesia and a patient with mega-oesophagus should be considered a regurgitation risk and managed accordingly. Having a plan of action to deal with potential problems identified should they occur will result in improved patient outcome.

Breed Considerations

Breed considerations can also influence anaesthetic protocols:

- The brachycephalic group should prompt us to consider possible difficult intubation and late extubation, careful monitoring after pre-medication and in recovery in addition to the considerations previously outlined.
- Dobermans are known to be a breed with a high incidence of abnormally low von Willebrands factor concentrations. Screening or at the least a buccal mucousal bleeding time should be assessed in all cases prior to anaesthesia. Dogs that are shown to be deficient in von Willebrands factor will require treatment usually with desmopressin and cryoprecipitate.
- Boxers appear to have a genetic disposition to acepromazine sensitivity and therefore acepromazine should be avoided altogether or doses should be significantly reduced.

- Greyhounds and sight hounds are not well suited to barbiturate anaesthesia due to the method of redistribution of these drugs and the inability of greyhounds to metabolise the barbiturate group. A different induction agent should be considered i.e. propofol or alfaxan.
- Miniature Schnauzers are at risk for developing sick sinus syndrome and should have an electrocardiogram (ECG) evaluated prior to anaesthesia.

ASA Scale

An American Society of Anaesthesiologists (ASA) physical status category can be assigned to the patient. This is a scale from from 1 to 5 (see table 1) with 1 being a healthy patient and 5 being moribund and unlikely to survive 24 hours without surgery. The ASA scale has been shown to be predictive of anaesthetic morbidity and mortality. By giving each of our cases a category it will help us to assign relative anaesthetic risk to each patient based on their health status and alter anaesthetic protocols accordingly.

ASA Scale	**Physical Description**	**Examples** (use a guide only a grading can be controversial)
1	Normal healthy patient with no underlying disease	Ovariohysterectomy, castration, Hip radiographs
2	Mild systemic disease is present but does not limit normal function	Controlled diabetes mellitus, compensated cardiac disease, localised infection
3	Patients with severe systemic disease	Anaemia, fever, dehydration, moderate hypovolaemia
4	Patients with severe systemic disease that is a constant threat to life	Uncompensated cardiac disease, severe dehydration and hypovolaemia, sepsis
5	Moribund patient not expected to survive 24 hours without surgery	Extreme shock and dehydration, severe trauma, multiple organ failure

American Society of Anaesthesiologists (ASA) scale of classification.

Surgical Considerations

By considering the type of surgery that will be performed we can evaluate factors such as pain, risk of haemorrhage, the possibility of hypo or hyperthermia occurring, any problems with ventilation that can be expected e.g. pressure being exerted on the diaphragm by a gravid uterus, surgical pressure in the cranial abdomen or the use of a neuromuscular blocking agent. By considering these things potentially useful drugs can have their doses and infusion rates calculated and can be prepared for use if required, appropriate intravenous fluids can be used for surgical maintenance and others such as glucose saline or colloids kept close at hand, Bair huggers™, Hot Dogs™ and other heating devices can be utilised to maintain appropriate temperature, non-rebreathing anaesthetic systems and non-heating bacterial filters can be prepared for patients evaluated as at risk of hyperthermia, analgesic techniques such as local blocks or epidural can be discussed and prepared for etc.

Equipment Considerations

Attention to detail is paramount when considering our anaesthetic equipment (includes the anaesthetic machine and breathing system). By adequately checking and preparing equipment in advance we can minimise the risk posed by equipment failure. In addition to checking for faults we should make sure that we have all the required equipment ready before starting i.e. do we have enough fluid pumps ready if the patient requires colloids or blood products? Do we have syringe drivers for our analgesic constant rate infusions? Is there a ventilator set up and checked for the thoractomy patient? Do we have a glucometer for our diabetic or a suction machine for our megaoesophagus?

Patient Preparation

Preparation of the patient is also essential. Consider and discuss with the veterinary surgeon how long the patient has been/ should be fasted for. A patient that has not been fasted will present a vomiting/ regurgitation risk whilst a paediatric patient is at risk of hypoglycaemia if fasted excessively. It has been shown that prolonged fasting increases gastric reflux and gastric acidity therefore prolonged fasting should be avoided. Water should not be withheld for long periods to prevent dehydration.

This may seem like a long list of things to consider but if we can get into the habit of looking at each case holistically and individually, list the potential patient and surgical complications, consider anaesthetic protocols, solutions to the problems posed and equipment required and finally gather and check equipment and ensure we have everything needed not only will this increase efficiency during anaesthesia and create a more balanced anaesthetic for the patient it will also improve patient outcome.

How can we prepare?

- Plan and prepare – write it all down?
- Checklists
- Equipment checks
- Knowledge – equipment, drugs, manage and treat problems
- Careful monitoring – appropriate reaction
- Gather everything we might need

- Prepare for the worst
- Ensure we have signed consent!

Is your anaesthesia safe?

Anaesthesia can never be 'too safe' and it is doubtful that anybody could currently say that their anaesthetics are as safe as they could be. We need to minimize things going wrong and maximize things going right by identifying potential problems and learning to counter them to enable a comprehensive, safe approach to optimizing outcomes for our anaesthetized patients.

Causes of Anaesthetic Critical Incidents

Human error

There are many factors that can contribute to human error and these include:

- Miscalculation of anaesthetic drug doses
- An incomplete clinical assessment (i.e. an inadequate history or physical exam)
- Inadequate knowledge of the anaesthetic machine or anaesthetic drugs being used
- Errors in administration of anaesthetic drugs (i.e. misidentification of drugs, incorrect route of administration, incorrect dosage). Failure to appropriately monitor the patient. Most emergencies can be avoided or quickly treated through careful monitoring and early detection and few serious complications and emergencies are truly immediate in onset. Failure to carefully monitor the anaesthetic (which may be due to other constraints on the anesthetist's time, complacency or fatigue) will mean that the anaesthetist fails to recognize the early warning signs of a possible complication.

A number of things can be done in order to reduce these errors

- Always double check calculations
- Perform a clinical evaluation of every patient before you anaesthetise it
- Always check that you know the anaesthetic machine you are using and that it is checked before anaesthetising the patient
- Always label drugs clearly
- Be vigilant of the patient's vital signs at all times and monitor the patient continuously

Equipment failure and error

True equipment failure is relatively rare – usually human error that causes the equipment failure.

Learning from our errors

We must reflect on the things that go wrong to allow us to move forwards within a framework of constant improvement and responsiveness to error.

This should be done in a fair and just manner without a 'blame culture' and take into account situational factors such as;

- Institutional context
- Organisational & management factors
- Work environment
- Team factor
- Individual (staff) factors
- Patient characteristics

Checklists

Checklists and procedural guides are proven to strengthen our cognitive processes and strengthen weaknesses in human factors thereby greatly reducing error, adverse events and fatality. They simplify complex, long processes into 'step by step' guides ensuring that steps are not missed and that all staff approach processes in a standardized fashion.

The Association of Veterinary Anaesthetists have recently published an anaesthetic safety checklist and associated procedural guide modelled on the World Health Organisisation Surgical Safety Checklist but with more emphasis on anaesthesia:
https://www.ava.eu.com/anaesthetic-records-safety-checklists/

It contains safety tasks that should be completed at key stages in the anaesthetic process:

1. **Pre-induction**
2. **Pre-procedure**
3. **Pre-recovery**

It also incorporates a machine checklists (discussed further in the next webinar) and pre-anaesthetic patient assessment questions;

1. Has anything significant been identified in the history and /or clinical examination?
2. Do any abnormalities warrant further investigation?
3. Can any abnormalities be stabilised prior to anaesthesia?
4. What complications are anticipated during anaesthesia?
5. How can these complications be managed?
6. Would the patient benefit from premedication?
7. How will any pain associated with the procedure be managed?
8. How will anaesthesia be induced & maintained?
9. How will the patient be monitored?

10. How will the patient's body temperature be maintained?
11. How will the patient be managed in the post-anaesthetic period?
12. Are the required facilities, personnel & drugs available?

"To effect improvement, the first step is to admit and record the lack of perfection.
The next step is to analyze the causes of failure and to determine whether these causes are controllable.
We can then rationally set about effecting improvement....."

-EA Codman, 1918

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Further Reading

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