ANESTHESIA: SAFE PROTOCOLS, MONITORING AND PRACTICE

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Most, if not all, veterinary clinics and hospitals in the country have the capability to perform some level of sedation and/or anesthesia on their patients. In most settings, the responsibility of anesthetizing/monitoring these patients falls to the technician. We have all had situations in our career that have made us uncomfortable and wanting to run… far away. So how can we overcome this phobia of anesthesia monitoring?

We start by continuously educating ourselves. We form a better understanding of the medications administered to our patients, including strengths, dosages and expected side effects. We develop safe and effective protocols and checklists to be used for every patient, every time. We create a higher standard for ourselves, our patients, and our team. When all of this is achieved, this phobia of anesthetizing our patients suddenly becomes more manageable (I don't want to say this phobia goes away, because I truly believe that the moment one no longer has fear is the moment one become careless; allowing for mistakes to happen).

"There are no safe anesthetic agents, there are no safe anesthetic procedures. There are only safe anesthetists." -Robert Smith, MD

ASA STATUS

I. Normal healthy patient
II. Patient with mild systemic disease
III. Patient with moderate systemic disease
IV. Patient with severe systemic disease
V. Moribund patient that is not expected to survive without the operation or intervention
E. Accompanies the assigned ASA status to denote urgency

Shelby, Amanda M., McKune, Carolyn M. *Small Animal Anesthesia Techniques*. Ames: John Wiley and Sons, Inc. 2014. Print.

Set Up

The drugs that are decided for each patient are dosed out in mg/kg (or mcg/kg, etc.). When discussing drug amounts, it is important to understand what your dose is. Because there can be a variance in concentration of a medication (especially if the medication is diluted), it is better practice to refer to medications in their strength (mg, mcg, etc.). For example, if I used 6 mL of propofol during induction of a 30 kg dog, I would refer to the dose as 60 mg or 2 mg/kg. Thinking in terms of mg/kg allows you to double check the doctors orders (or calculations if the doctor performs their own calculations in their practice).

Emergency drugs should be calculated ahead of time for reversal agents (i.e. naloxone, flumazenil, atipamezole) and CPR drugs (i.e. atropine, epinephrine) in case they are needed. Calculating CRI (continuous rate infusion) drugs allow for quicker set-up should they be needed during anesthesia (i.e. fentanyl, dopamine, dobutamine, norepinephrine). At CUVS, we print out an emergency drug sheet for every anesthetic case, whether it be a routine orthopedic or unstable GDV.

It should be standard practice that, prior to anesthetizing a patient, the anesthesia machine is checked for the presence fresh gas flow and that no leaks are present. Check that the anesthetic gas vaporizer is full and that the sodasorb has not expired. Confirm that the waste gas system is present and functioning (turn on vacuum for active system or check patency on a passive system). Selecting a reservoir bag/deciding on what type of breathing circuit to use are also very important.

Knowing your patient's breath volume is referred to as tidal volume (TV). TV is calculated at 10 - 20 mL/kg. Keep in mind that if a patient is overweight, the values are going to be artificially higher, so tidal volume should always be calculated based on an ideal body weight. Once the TV is calculated, the next step is determining the reservoir bag size. To determine the reservoir bag size, multiply the TV by a minute ventilation of 6. Because TV has a range, it is best to multiply the minute ventilation by 20 to be sure a big enough reservoir bag is chosen. However, the reservoir bag should not be so large that it becomes hard to visualize any movement when the patient takes a breath.

The two common circuits used during anesthesia are a circle system and non-rebreather system. A circle system is one that has the presence of unidirectional valves, allowing the flow of gas to travel in one direction. As the gas is exhaled, it passes through an absorbent (i.e. SodaSorb) that filters out the CO_2. Once the gas passes through the CO_2 absorbent, it returns to the patient again. A non-rebreathing circuit does not recycle any gas exhaled from the patient, instead it relies on a higher oxygen flow rate to push the exhaled breath into the scavenge system. If a patient is less than 5 kg, using a non-rebreather circuit is recommended. The resistance within the circle system affects smaller patients (i.e. the pressure/force needed for a patient to breathe through the sodasorb canister). With the non-rebreather circuit, there are no valves present within the tubing to allow passage of gas in one direction only. This means that the fresh gas flow (oxygen flow meter) must be set high enough to push the exhaled breath far enough down the waste gas line. If possible, capnography should be used to determine the presence of inspired CO_2. If capnography is not available, an oxygen flow rate of 3 L/min should be used.

Choosing an endotracheal tube should be based on patient size and breed. Assessing the width between the two nares is a great reference for selecting a tube. The tube should fit snug in the trachea but pass easily. Choosing a tube that is much smaller in diameter than the diameter of the trachea will create more resistance and strain for the patient to breath on their own. However, forcing a large tube into the trachea will cause irritation that can lead to postoperative tracheitis and coughing. Aside from the tube diameter, the length of the endotracheal tube (once inserted into the trachea to the depth of the thoracic inlet) should not extend very far beyond the patient's nose. Keep in mind that the endotracheal tube extends the amount of dead space within the patient's anatomy by artificially extending the length of the trachea. Dead space volume is included and takes up an amount in the patient's TV, so cutting back an endotracheal tube may be required in smaller patients to prevent them from becoming hypercapnic/hypoxic.

Patient Monitoring

At a minimum, monitoring equipment should be used to assess heart rate/rhythm, SPO_2, and blood pressure. Other monitoring parameters include capnography and temperature. ECG monitoring is important to be sure the rate and rhythm are within normal parameters. If monopolar cautery is used during surgery, it will interfere with the ECG. For this reason, it is

best to use either the SPO_2 or a doppler as the source of your heart rate (some machines allow you to designate the beep source to either the ECG or SPO_2 monitor).
Spo2 is important to monitor oxygenation status. The SPO_2 sensor can be placed on the tongue, prepuce, ear, or lip. Most commonly, the tongue is the desired location for the SPO_2 sensor since the moisture helps conduct the light better. That being said, as the tongue dries out, the SPO_2 readings may start to drop. A quick fix is to wrap the tongue with a wet gauze and place the SPO_2 sensor over the gauze (by keeping the gauze in place, it delays the drying time of the tongue). If the patient is placed in dorsal recumbency, the weight of the lower jaw can occlude the tongue, causing the SPO_2 value to drop. Simply placing a wedge (like a 3 cc syringe casing) in the mouth for the jaw to rest on will increase blood flow to the tongue and allow for a more accurate SPO_2 reading. If the SPO_2 is reading less than 97%, troubleshooting should be performed to rule out user error.

Blood pressure monitoring is very important to assess perfusion. The means of obtaining a blood pressure during anesthesia are by non-invasive (doppler or oscillometric) and invasive (via arterial access). Doppler readings rely on the user listening for audible heart beats while oscillometric readings use a machine to measure the oscillations during a heart beat. Some patients require one method over the other for monitoring blood pressure. The blood pressure cuff should be placed on an area of the patient that is relatively cylindrical. Areas like the base of the tail, forelimb antebrachium, or hindlimb dorsal pedal are preferred for oscillometric. Patients with stubby limbs (ie dachshunds, bull dogs, etc.) should have their reading performed off of the base of their tail (assuming they have a tail!). If there is not a tail present, consideration for use of a doppler should be taken. Blood pressure is measured as systolic, diastolic, and mean. The mean reading should never drop below 60 mm Hg. As a general guideline, during anesthesia, the BP mean should remain around or above 70 mm Hg. This allows for wiggle room to address drops in blood pressure without causing the patient to have a BP mean below 60 mm Hg. When troubleshooting the causes of anesthetic hypotension, the number one culprit is the inhalant gas. If a patient is anesthetized (i.e. not waking up) and is hypotensive, the inhalant vaporizer dial MUST be turned down. If the patient is too light and hypotensive (i.e. presence of palpebral reflexes), another modality must be added to the protocol (i.e some drug to lower the patients mean alveolar concentration [MAC] such as an opioid bolus or initiating a fentanyl CRI). Another alternative to anesthetic hypotension is initiating a dopamine or norepinephrine CRI to increase vasoconstriction.

Capnography is a great tool to assess patient ventilation. In most cases, once a patient is anesthetized, their EtCO2 may steadily increase, which is an indication of hypoventilation. The capnograph will also indicate a leak or occlusion present within the endotracheal tube. During anesthesia, a patient should have an EtCO2 reading of 30 - 40 mm Hg.

Recovery

Anesthetic deaths occur primarily during induction and recovery. Once a patient is breathing well on its own, they should be disconnected from the anesthesia machine and monitoring equipment for transfer to recovery. The endotracheal tube cuff should not be deflated until the patient is sternal and their gag reflex has returned. If a patient has a rapid wake up, keep propofol on hand to administer emergently if they bite the tube or begin thrashing (this excitable phase is referred to as emergence delirium). The veterinarian may also prefer a sedative such as acepromazine or dexmedetomidine. Whichever option is preferred, a conversation with the doctor and plan should be in place before the patient is transferred to recovery.

In recovery, the patient's chest and head should be in sternal recumbency with their head elevated. This is especially important if the patient has received a postoperative sedative so as to decrease the chance of postoperative regurgitation. Patient's that are stimulated to for a faster extubation, are at risk for becoming sedate again once the stimulation has stopped. Patients should also receive heat support until their body temperature has returned to normal (minimum of 99 F). Lubricate both eyes every 4 hours or as needed during recovery to minimize complications associated with dry eyes.

Conclusion

Overall, care should be taken into preparing the work environment and equipment to be sure all is functioning properly BEFORE a patient is placed under general anesthesia. Knowing the patient ASA status and what the owners wishes are for resuscitation will help to better prepare the team for any emergencies. Having a pre-calculated emergency drug protocol printed for each case will expedite the process of obtaining drugs needed during an emergency. Preparing for the worst is far better than going with the flow and hoping for the best.

"By failing to prepare, you are preparing to fail." - Benjamin Franklin