Proper preparation and a plan for dealing with potential complications are important factors in a successful anesthetic event involving a patient with respiratory compromise. As always, any patient requiring anesthesia should be “worked up” by the anesthetist prior to induction. Every effort should be made to get the patient as stable as possible before anesthetic agents are administered. Ideally, a complete physical exam including auscultation of the upper airway and lungs is indicated. Patient history, blood work and other indicated laboratory testing should be completed prior to induction when possible. Chest radiographs are obviously indicated for patients with lower airway symptoms to help determine the cause of the compromise and as a rule out for metastasis when masses or tumors are suspected. Unfortunately, with cases of acute respiratory/airway compromise, this is not always possible. Simply restraining the patient for radiographs and changing its recumbency can be catastrophic. Patients that cannot ventilate adequately are usually extremely anxious and are working very hard to attempt to ventilate themselves. Oxygen consumption in these patients rises with the anxiety level so that pets have difficulty keeping up with their oxygen demands. These patients are often overheated and frequently near exhaustion depending on the severity of the disease or trauma. In these patients, often the best thing to do is to induce anesthesia and capture the airway as soon as possible. Further work-up can follow once the patient has a patent airway, is intubated and stabilized. In all cases supplemental oxygen should be supplied in some way.

Pre-oxygenation of any patient is never a bad idea as long as it is tolerated and doesn’t add to pre-existing stress levels. Pre-oxygenation is a technique that can “buy time” before the onset of hypoxemia. In cases where intubation may be difficult or prolonged or if the patient may become apneic due to induction drugs, preoxygenating increases the oxygen content within the functional residual capacity of the lungs. It takes only 90 seconds for a patient that has not been pre-oxygenated to become hypoxemic in the event of an airway obstruction as compared to 3-4 minutes in a pre-oxygenated patient. It’s a simple technique that is highly recommended.

Most anesthetic agents cause respiratory depression to some degree. The anesthetist must consider the side effects of any potential premedication drug before it is given in order to anticipate potential worsening of hypoventilation and hypoxemia. The pure agonist opioids (oxymorphone, hydromorphone, morphine and fentanyl) are potent analgesics but also potent respiratory depressants. Although the effects are dose dependent in the most critical cases where patients are having difficulty ventilating adequately they might not be the best option for administration prior to induction. In non-painful patients, opioids can cause vomiting. For the respiratory challenged patient where aspiration is a big concern, this should be a consideration prior to administration. The opioid agonist-antagonist butorphanol causes minimal respiratory depression and good sedation but it will not provide adequate analgesia for thoracic surgery. If the patient is critical but stable and ventilating adequately a neuroleptanalgesic technique can be used for premedication. Usually this entails using a benzodiazepine such as diazepam or midazolam, along with an opioid. This combination can be given IM or if the patient has an IV catheter already in place, the two drugs can be titrated separately, IV, to effect. Benzodiazepines have minimal effects on the respiratory system at therapeutic doses and so are considered good choices for use in respiratory compromised patients. When used alone in otherwise healthy dogs excitement can be seen. For that reason, in the healthy dogs, it is best to titrate a bit of the opioid
dose in first, flush it in and then administer the benzodiazepine. In critical patients and those exhausted from the work of trying to maintain ventilation, titrating to effect makes sense as much lower doses of each drug may be needed to reach the desired effect.

Acepromazine is the most commonly used phenothiazine tranquilizer used in veterinary medicine. It has minimal effects on ventilation although higher doses can have depressant effects. Acepromazine can lower the respiratory rate in some patients but minute volume usually remains unchanged because tidal volume increases. Low doses (0.02-0.04 mg/kg) can be useful in patients that are anxious and distressed over acute respiratory dysfunction. The side effects of acepromazine include vasodilation which can exacerbate hypotension. It can be ideal, however, in patients that are anxious at being hospitalized or those whose distress from the effort of maintaining ventilation worsens their upper airway obstruction. It can also be an ideal drug to use for post-operative ventilation anxiety.

The \( \alpha \) agonists (xylazine, dexmedetomidine) have variable effects on the respiratory system depending on the dose and the patient. Some patients will have only slight respiratory depression while others show a marked effect. These drugs cause vasoconstriction and therefore can cause mucous membranes to blanch or appear bluish in color. This can be mistaken for cyanosis when in fact arterial partial pressure of oxygen is normal or near normal. Alpha-2 agonists also cause a degree of hypotension and cardiovascular depression. Although the effects of these drugs can be reversed with atipamazole, they are not recommended for use in the critical patient.

The anticholinergic drugs atropine and glycopyrrolate work by blocking stimulation of the vagus nerve reversing parasympathetic effects. In patients with high existing vagal tone, such as the brachycephalic breeds, anticholinergic use as part of the premedication protocol is recommended. These drugs also decrease salivary and bronchial secretions which can be beneficial in some patients as well. In the critical or highly stressed animal administration of anticholinergics is contraindicated. Usually these patients are already tachycardic or cardiovascularly compromised and the increase in myocardial work and subsequent increase in oxygen consumption caused by anticholinergics can be detrimental.

Regardless of the premedication chosen, respiratory compromised patients should not be left unsupervised once the drugs have been given. Premedication can cause muscle relaxation of the upper airway muscles which can lead to worsening obstruction or the compensatory mechanisms employed by patients with airway compromise may be obtunded requiring immediate induction and intubation. In most cases, the benefits of premedication outweigh the risks as long as careful supervision and monitoring take place.

Any induction agent that allows for rapid intubation should be used in a respiratory compromised patient. As always, the side effects of each drug need to be considered especially in patients that are surgical candidates. Propofol induces anesthesia quickly but can cause transient apnea and hypotension following induction. If there is any indication that intubation may be difficult or prolonged it may be best to look to another induction agent. Pentothal also induces patients quickly, but may cause a brief excitement phase and its side effects need to be considered especially in fragile patients. Ketamine/midazolam (or diazepam) may be a good choice because the ketamine can indirectly support the cardiovascular system and provide some analgesia and the midazolam provides good muscle relaxation. Etomidate may not be a good choice when quick airway control is the goal as it can also cause transient respiratory depression and apnea. Unless the patient is well sedated, or the drug is combined with a benzodiazepine for
induction, excitement is sometimes seen. Etomidate may be the drug of choice, however, in a fragile patient with cardiovascular compromise.

Mask or chamber inductions are a very risky and poor choice for the respiratory compromised patient. They can add to the stress level of an already compromised pet and don’t allow for rapid capture of the airway.

References:

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