**Practical Readiness and Care for the Most Critical**

**Those Struggling to Breath**

**Part 1**

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**Introduction:**

**The description: Presentation of important and practical assessment and therapy protocols and techniques of the difficult breathing patient.**

-To review the most critical aspects of facility and team readiness for care of the difficult breathing patient.

            - To review the techniques of assessment and initial care of difficult breathing patient examples with emphasis on the oral cavity, larynx and trachea

            -To provide case examples of difficult breathing patients to highlight important aspects of assessment and care protocols and procedures involving the upper airway

**Abstract:** Since triage was established by the military in the first century those patients with difficult breathing were and still are considered the most challenging to fully assess and successfully care for. In today’s human emergency care environment and in veterinary practices this is continues to be similar.

As an active first responder (firefighter, advanced emergency medical technician – medic with the fire department and a rescue specialist) I will bring information to these presentations that might be unique in I will provide information that will also apply to you as a veterinarian or veterinary technician (nurse) that, heaven forbid, you might draw from as a need: the care of human patients should a massive disaster occur (where you will have no other choice.. as there may not be anyone else with your background or training (nearest that of a human medic or emergency nurse or physician). In the immediate aftermath of a mass casualty event if you are spared and can provide care to those sick and critically injured, your actions may help save the lives of many.

As an example is severe hemorrhage where your application of pressure, or the use of a tourniquet above the arterial bleeding area or the packing of the bleeding cavity in the torso or groin of armpit region will arrest stop it and likely save the person’s life. Yet, if this bleeding is not stopped by what you do, the results will be irreversible shock and death. Yes, this stuffing of bleeding cavity may be difficult for you to do but there may be NO ONE ELSE to this; to stop the bleeding or as what happen to me some years ago – I was driving my car and I was near an intersection; and a motor cycle rider hit a car broadside and he went sailing over the car and landed in a field. I stopped and my car and ran over to see how he was. His head was face-planted to the dirt and there was a slight sound I could hear that was the only indication he was alive. I immediately rolled him over and extended his head and neck and removed his helmet that was full of dirt.

**IN ALL – CARE BEGINS WITH ASSESSMENT of the scene and the patient:**

**Scene Survey**: Always put on a pair of exam gloves and if possible, protective eye ware. Blood from a human and a dog or bat looks the same. Human hepatitis virus is hearty and can infect you its from the blood of a person that has hepatitis and separated his dog from a larger dog and in the process was bitten and sustained a bleeding wound that was not serious but none the less contaminated the dog who was also bitten. The human blood containing the active hepatitis virus is on the dog and not be separated from the dog’s blood that is in his hair coat. This scenario is mentioned not to frighten anyone but teach everyone that they need to wear gloves when seeing emergency patients. More reasons to wear gloves include various toxic materials which can lead major consequences should they get on the examiner’s skin. These include Aldicarb (Temik) a highly toxic carbamate insecticide (one of the most acutely hazardous pesticide still used in the US, but now band that can be easily absorbed and can cause seizures, coma and death; Here is a news report from Australia – as you can see it occurs even in other countries: “ Please spread the word. Dog poisoning on the increase in Northern and Western Johannesburg suburbs. Try to keep your dog’s away from front gates and let them sleep inside at night. 30 dog poisoning related incidents over the past two weekends early hours of Friday, Saturday and Sunday mornings across Northwold, Chartwell, Farmall, Bloubosrand and Olivedale. Tragically there have been 5 deaths. Temik (2 Step) used in most cases.

 Carfentanyl, a drug used on the street by drug users, which is a fentanyl like product a1,000 times more potent than fentanyl might be topically on the pet’s hair coat and which comes in contact with the veterinarian’s or vet tech’s skin could also cause a rapid onset of coma and death. This has occurred sadly with the death of several first responders. Here is a news report about another police officer:

 “East Liverpool Police officer suffers fentanyl overdose from drug call [http://dlvr.it/P8DTJv](https://t.co/6WKwC8LTFR%22%20%5Co%20%22http%3A//dlvr.it/P8DTJv%22%20%5Ct%20%22_blank)

[10:05 PM - 14 May 2017](https://twitter.com/WKBN/status/863938279401431040) Within minutes, he fell to the floor. “I started talking weird. I slowly felt my body shutting down. I could hear them talking, but I couldn’t respond,” Green told Morning Journal. “I was in total shock. ‘No way I’m overdosing,’ I thought.” Paramedics were already on scene tending to Justin Buckle, 25, the driver of the car, and diverted their attention to Green. They gave him one dose of Narcan, an FDA-approved nasal spray version of a lifesaving medication called naloxone that can reverse the lethal effects of an opioid overdose. Green was transferred to East Liverpool City Hospital and given three additional doses of Narcan, East Liverpool Police Capt. Patrick Wright [told TV station WKBN](http://wkbn.com/2017/05/14/east-liverpool-police-officer-suffers-fentanyl-overdose-from-drug-call/%22%20%5Ct%20%22_blank). “If he would have been alone, he would have been dead,” Police Chief John Lane told Morning Journal. “That’s how dangerous this stuff is.”

Note that the Narcan was administered into the nasal passage using an atomizer. It’s a very good way to provide emergency drugs including Naloxone; Epinephrine; Midazolam, Flunazanil; and possibly glucose, atropine; In human health care proponents of intranasal IN atomized drug administration of opiates argue that there is large inter-patient variability in clinical effects from opiates with intravenous, oral, or intramuscular administration, and that this should not *a priori* preclude the use of IN opiate delivery. Furthermore, the potentially large operator variability in IN drug administration can be minimized by dosage and method standardization. Despite these controversies, multiple studies have shown the utility of IN opiate administration in pre-hospital and emergency settings, including using IN fentanyl and ketamine in burn dressing changes, IN diamorphine in sickle cell crisis patients, IN fentanyl in ambulance ride patients, and IN fentanyl in pediatric emergency department patients with pain (Telfer et al., Rickard et al., others). Most of these studies have had clear results in favor of the use of IN opiates. Along the same vein, IN antidotes to narcotics and benzodiazepines (such as naloxone and flumazenil, respectively), have been tested to a limited extent, but with good results.

**Physical Assessment:** Following the dawning of gloves and protective eye wear the patient’s assessment is begun: This always starts with determining the pet’s Level of Consciousness and then airway patency and followed by breathing effectiveness. Blow by oxygen is commonly provided with a plastic “canopy” added to increase the percent of oxygen should there be any increased breathing effort. The pattern of the breathing is characterized and auscultation is completed.

Those not conscious are then assessed for A and B - Commonly the tongue is pulled rostrally and using a light or best with a laryngoscope, the airway is examined and an ET tube placed;

**AIRWAY** - If the airway is not clear and ET tube placement cannot be done bag valve mask ventilation can be attempted while preparations made for an emergency tracheotomy and this is performed if BVM ventilation is not successful;

Awake tracheotomy may be accomplished if its obvious from examination that airway compromise is severe. If the trachea is significantly compromised rapid access is completed and a tube placed distally to provide a means of giving ventilations;

EMERGENCY PROCEDURES - Other needed emergency procedures that might be needed include:

IV access (even by cut-down if needed) or IO cannula placement;

suctioning of the oral cavity, pharynx, larynx, and trachea;

Bag valve mask ventilation or attempted ventilation using a PEEP valve.

These are done within minutes of arrival – it’s a ***“timed event”*** in that if seconds are lost this might also lead to the loss of the patient, as “oxygen cannot be stored”

**Assessment with difficult breathing patient begins by observing type of effort and breathing pattern; listening to airway and breath sounds;**

Rapid and shallow think then of pleural space conditions such as pneumothorax; diaphragmatic hernia; severe pneumomedastinum, hemothorax, chylothorax, pyothorax or hydrothorax;

Deep slow breaths with effort think possible airway compromise or lung parenchyma compromise such as that noted with pneumonia ;

Commonly the upper airway will also then be listened to with a stethoscope and the sounds characterized. High pitch sounds = 70% obstruction at the larynx; Low pitch gurgling or snoring sounds = 70% obstruction at the pharynx; Quieter sounds = less than 70% obstruction; the trachea is then auscultated and higher intense sounds assessed for which would indicate anatomic narrowing.

Palpation is then done. Free air under the skin, if detected, indicates some perforation and air leakage. Large gaps in the trachea if palpated indicates a tear or separation. If the airway is significantly compromised to the point of obstruction then an emergent entry to the neck by rapid entry after clipping and prepping (best using a non-toxic surgical prep. There is, as far as I know, only one that is commercially available. This is Techni-Care (Care-Tech Laboratories, Saint Louis, MO www.caretechlabs.com). All those that contain chlorhexidine with invoke irreversible neurotoxicity to any nerves contacted by the agent; and if the eyes get contaminated this can lead to permanent blindness.

Then the thorax is auscultated and percussed.

**ULTRASOUND ASSESSMENT** - Place an ultrasound probe on the thorax/ cranial abdomen and (with practice) the larynx, trachea, and diaphragm and observing movement and characteristics. The US probe is the “new stethoscope” Of course the good old standard stethoscope is an amazing too and should be mastered by all who do emergency work.

Protocol for assessment with the US probe. This is often done as the patient arrives and blow by oxygen with a canopy is supplied:

No need to clip the hair just wet down with alcohol on the left hemothorax; examine for glide sign; B lines or “comet tails” indicating pulmonary edema; consolidation; move probe around to quickly establish assessment of pleural space, lungs, movement of the diaphragm, movement of the chest wall; quick assessment of blood flow in the heart. Then assess the right hemothorax the same way. If note loss of glide sign then tap the hemothorax on that involved side; the US probe can be used to help guide the thoracentesis catheter; attach an IV extension set and begin aspirating – aspirate as much air and blood as possible +++ save the blood for autotransfusion if that becomes needed.



**1 B line fairly dry 3or more = interstitial edema headlight fog = wet**

The A-line is a horizontal artifact indicating a normal lung surface. The B-line is a kind of comet-tail artifact indicating subpleural interstitial edema. When there are many you get a fog pattern like you would see by shining a light into the fog and this indicates more interstitial edema

The airway can also be evaluated with the US probe: Its first placed transversely and then longitudinally. The epiglottis and larynx and trachea can be evaluated. The view below of an adult person (being used as its easier to see and to learn the views looking for. Commonly used to evaluate the larynx and its movement the patient is placed in a position or comfort (often sitting up and possibly receiving blow by oxygen).



Then the probe is placed longitudinally and advanced side to side and the pharynx, larynx, and trachea should be assessed. Below is the left parasagittal view at thyrohyoid membrane (THM). H = Hyoid bone, SM = Strap muscles, THM = Thyrohyoid membrane, TC = Thyroid cartilage, PES = Pre-epiglottic space, E = Epiglottis, A–M = Air mucosal interface. At the midline the pretracheal and tracheal areas are identified.

The best way to get good enough to recognize the structures identified above as well as feel comfortable then to detect abnormalities or injuries to the structures being interrogated is to practice on normal animals and to then use the probe on those with breathing issues. Also a good way to practice airway ultrasound techniques is to perform US on animals undergoing anesthesia and tracheal intubation. A tube can also be placed into the esophagus too and brought out into the pharynx so that it too can be identified. These photos are taken from a human text.



**UPPER AIRWAY OBSTRUCTION CAUSES – PATH REVIEW**

Regarding the common reasons why the upper airway may be critically compromised include the following: acute reactions to insect bites, especially if these occur in a patient with an already marginal or compromised airway; laryngeal dysfunction such as those associated with laryngeal paralysis or laryngeal collapse; acute rodenticide toxicity causing a significant hematoma that may be sublingual; trauma of the mandible, maxilla, sinuses, significant bleeding from nose and pharynx; foreign bodies blocking the pharynx, larynx or trachea, injuries to the tongue, pharynx, larynx and trachea;

**PROCEDURES NEEDED TO SUCCESSFULLY TREAT OBSTRUCTED / INJURED UPPER AIRWAYS**

In reviewing common procedures used to successfully treat the compromised airway the following are listed (most likely in order that they are used):

1. Blow-by oxygen (often assisted with attachment of a “nozzle” to direct the oxygen down the pharynx);

2. Bag-valve mask ventilation with a PEEP valve attached to the exhalation side of the Ambu bag and attached to 100 % oxygen via a line/flow meter;

3. A rapid induction with ketamine (2-4 mg/kg) and midazolam (0.1-0.2 mg/kg) following hydromorphone (0.05 -0.1 mg/kg) if the hydro does not in itself quite the dog/cat enough decrease oxygen demand and struggling.

4. Laryngoscopic assisted intubation possibly using a stylet – possibly also using supine and lateral positions. Small tube placements.

5. Nasopharyngeal catheter(s) or nasotracheal oxygen catheter placement and use to supply oxygen supplementation and possibly the use of the addition of a larger than normally used E-collar and plastic wrap over the bottom 2/3rd s of the opening to trap oxygen flow and increase its percent.

6. Awake intubation where only the hydromorphone is used and then just enough ketamine and midazolam to allow slow purposeful intubation using jet blow by oxygen facilitating the ET tube placement (generally smaller)

7. Use of a Combi-Tube, King Airway or Hyper-expanded Cuffed ET tube placed into the pharynx and then attached to an AMBU to provide positive pressure ventilation with some of each breath finding itself into and through the obstructed area of the pharynx and or larynx and into the trachea.

NOTE: A homemade oro-pharyngeal airway can be made from a plastic syringe or syringe case with the ends both open. The ends are then taped to prevent injury to the soft tissues of the mouth and then a section of tape it attached to be used as a loop to be able to be used to retrieve it if it was needed on an emergency basis.

8. Awake rapid tracheotomy with a rapid clip done on medium to long haired dogs and cats and then if needed a mild amount of sedation provide and the pts head elevated and then a rapid approach to the mid-cervical trachea. Local infused lidocaine may be useful to facilitate pain control.

9. Tracheotomy completed after a small tube is placed into the trachea to give some time to be able to do the surgery in a more slow and controlled method.

10. Tracheal approach through a cervical or para-sternotomy and immediate securing of the trachea with direct tracheal placement.

11. Transtracheal catheter placement using an introducer needle that is placed into the trachea and a catheter slid through the needle and into the trachea. The needle is then withdrawn and taped to the catheter. The catheter is then secured with a suture. Then the catheter is taped around the neck and then attached to the oxygen supply line. 50 ml/kg/min of oxygen is a commonly used flow rate.

**CASE EXAMPLES** – The following are provide to give case examples of where these assessment and treatment modalities have been used in clinical practice:

Case 5: 7PM - You were about to leave for the day ☺ You are tired. A man came into the hospital in a female Golden Retriever, approximately 10 years old. She was approx. 10 years old the owner told us. He appeared to me to be in emotional shock and he said the dog had been hit by a car. He said “Do all you can to save her. She is my life.” Her name was Sarah –

On triage she was noted to be unconscious and bleeding significantly from an open hole in the left frontal sinus region. The left eye region was caked with blood and appeared to be missing. She was given immediately blow by oxygen and found her breathing mostly in an out from the large hole in her skull. The owner on triage was covered in blood and when we took his dog from him as he had been carrying the dog back tot the treatment area.

The owner, on questioning him, said he had been walking the dog. A car traveling estimated approximately 30 mph had hit the dog when he had started crossing a road on her head region. He was not sure if she had become immediately became unconscious but and he had noted the open hole and the bleeding. The owner was given a guarded prognosis as there was a no way to tell of recovery at this time. He was ushered back the reception area and paper-work filled out. He agreed to the care plan and emergency surgery that would be needed and a deposit of the low end of the estimate (3,000) was secured. He remained in the hospital while care was continued. He was

Further Triage Assessment - She was dripping bright red blood out of the hole and you could hear when each breath was initiated and with each exhaled breath. We laid her on the exam table on her right side. A quick assessment was done and LOC revealed nearly unconsciousness, some muscle tone, spontaneous breathing with added inhalation and exhalation sounds from the head and the mouth.

Auscultation revealed some breath sounds bilaterally and heart tones were recognized. There were upper airway referred sounds. It was noted that air and a spry of blood occurred with every exhalation. The area of the left eye was caked in blood and then was noted to be definitely ruptured.

The blow-by-oxygen was augmented with a 14 g catheter to make the jet (to make it jet -blow-by) and this was aimed at the open hole and mouth.

The mouth was opened, noting some resistance and suctioned with a *Yankauer* suction catheter was used to remove clots and bubbles and find the larynx. It was impossible to see the larynx because of all the blood and the swelling that had occurred.

A emergency tracheotomy was completed following a few rapid swipes with the clippers and application of Techni-Care. A bag of fluids was placed under the patient’s neck and she was secured with tape in a supine position with the neck extended over the bag. The incision was made and with rapid dissection the trachea was elevated and a transverse incision made while keeping the trachea immobilized. An ET tube was placed through the ostomy site. The cuff was inflated and ventilation initiated with a bag – valve mask (mask off) and reservoir attached to a 100% oxygen source. A Hallowell Anesthetic Ventilator with100% oxygen was then attached to free up a hand.

An IV catheter was placed using an 18 g needle to cut over the cephalic vein. A curved mosquito hemostat was used to dissect under the fairly collapsed vein. Then it was pulled toward me to make the vein taught and allowed placement of a 14 g catheter. It was taped in place.

Plasmalyte was begun at a bolus rapid rate 15 ml/kg (est. 500 ml) and 7.5% hypertonic saline (5 ml/kg), and Oxyglobin was given a 5 ml/kg each. Then as rapidly as possible a 125 ml bag of Fresh Frozen Plasma was thawed out each and given over a few minutes. Hetastarch (6,5%) was also given (2ml/kg).

A flat Doppler flow probe (Parks Medical Electronics) was secured over the palmar arterial, plugged in was turned on and no sounds were noted to be coming from it. Then within a few minutes the sounds were noted and gradually became more recognizable. Flows became stronger and now easily heard. A BP cuff was placed and BP was determined to be 60/30 – CRT was improving as well as membrane color, SpO2 was 97 and ETCO2 was noted to be 40 – and ECG and temp probe was placed an hypothermia was noted (97) but no warming was done (based on the CNS injury).

The right pupil was responsive yet somewhat sluggish. As fluids were continuing to be given the need for analgesia and anesthesia was apparent as the dog responded to palpation of the eye region so ketamine 2 mg/kg, hydromorphone 0.02 mg/kg, acepromazine 0.02 mg/kg, and atracurium 0.25/kg were given intravenously and isoflurane at 0.5% was begun to be administered.

Cephazolin 40 mg/kg and enrofloxicin 10 mg/kg was given slowly intravenously.

A rapid AFAST and T FAST were negative and attention was paid back to the CNS level. Now when the orbital rim was palpated there was no further movement.

Labs were done and revealed an increased lactate (6.5) and a metabolic and respiratory acidosis (pH 7.25, HBO3 14, pCO2 55, pO2 65) and an ALT 500, and other values were wnl other than only 100 platelets and a aPTT slightly prolonged. A thoracic and head and neck radiographs were completed and revealed multiple fracture segments to the frontal cavity. There was some evidence of pulmonary contusion but no pneumothorax .

The hair was clipped over the head and neck and after vacuuming the dog was taken to the OR and Techni-Care chloroxylenol 3%(CareTech Labs 800-325-9681). After draping and laying out the needed instrumentation including suction, RF electrocautery, an approach was made to the nasal and frontal bones. After the skin approach was done and the placement of Gelpi retractors multiple free pieces of bone were removed (approx. 30). Upon the removal of one of the larger sections that was gammed into the sphenoid region bleeding became severe. Packing was required and some Hemoblock was also stuffed into the deep portion of the pack and that was successfully staunching the hemorrhage. The ruptured eye tissue was removed along with other pieces of free bone and the pack was then removed. A-Cell was a then used to close the open area of the frontal sinus and nasal bone where it was missing. Then the skin was closed over the A-Cell. Cell manufactures the only commercially available extracellular matrix (ECM) made of urinary bladder matrix (UBM). ACELL, INC. Columbia, Maryland. This is a scaffold used to support the wound fibroblasts creeping up over the ACell sheet. It contains growth factors and stimulates fibroblastic activity over the sheet of ACell.

A dressing was applied over the head and only after the surgery was completed was active rewarming begun.

Ventilation with the Hallowell ventilator was continued postop and the analgesia was continued with CRI lidocaine (50 ng/kg/min) morphine 3 (2-6) ug/kg/min or 0.002 to 0.006 mg/kg/min and ketamine 2 to 20 ug/kg/minute (0.12 to 1.2 mg/kg/hr) was provided for analgesia and continued mental suppression to allow the brain to gently recover from the trauma. Acepromazine in small antianxiety doses (0.5 mg) was used to help the dog from flaying around . Plasmalyte and ProcalAmine both at 2 ml/kg per hour were started to provided a nutritional support after she gained consciousness as a CRI to help ameliorate any concerns for nutrition. ProcalAmine® (B. Braun) (3% Amino Acid and 3% Glycerin Injection with Electrolytes) is a sterile, nonpyrogenic, moderately hypertonic intravenous injection containing crystalline amino acids, a nonprotein energy substrate and maintenance electrolytes. A 1000 mL unit provides a total of 29 g of protein equivalent (4.6 g N) and 130 nonprotein calories.

The ProcalAmine® provides a physiological ratio of biologically utilizable essential and nonessential amino acids, a nonprotein energy source, and a balanced pattern of maintenance electrolytes.

The amino acids provide substrates for protein synthesis as well as sparing body protein and muscle mass. Glycerin USP (glycerol), a utilizable energy substrate, is also provided which serves to preserve body protein. Glycerol participates as an active energy substrate through its phosphorylation to α-glycerophosphate and subsequent conversion to dihydroxyacetone phosphate, one of the two key trioses in the metabolism of glucose for energy generation.

While she was under general anesthesia a small tube (6 Fr. (Biosearch) catheter was placed as a nasogastric tube and trickle feeding (0.2 to 2 ml each hour) was started approximately 4 hours post op. Over the course of the next 5 days Sarah became much more active and liquid feeding was gradually increased. She was able to be discharged on day 5 and the owner instructed to just keep the tracheotomy site clean and then was seen here at 10 days post op and then removed the tracheal stay sutures. Another 3 weeks later she came in for her last recheck. The previous tracheotomy site was healed closed and the dog was neurologically sound.

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