**Diseases of the Respiratory System**

**Principles of Treatment & Control of Respiratory Tract Disease**

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**TREATMENT OF RESPIRATORY DISEASE**

**Treatment of diseases of the lower respiratory tract depends on the cause of the disease. However, the common principles are:**

**1- Ensure adequate oxygenation of blood and excretion of carbon dioxide.**

**2- Relieve pulmonary inflammation.**

**3- Effectively treat infectious causes of respiratory disease**

**4- Relieve broncho-constriction.**

**4- Supportive care to minimize demands for respiratory gas transport.**

**Respiratory gas transport  
- Cause of acute death in animals with respiratory disease is usually failure of transport of respiratory gases with subsequent hypoxemia and hypercapnia.  
- Treatment of failure of oxygenation of blood and excretion of carbon dioxide can be achieved through administration of supplemental oxygen or mechanical ventilation.  
- The reasons for failure of respiratory gas transport should be considered when therapy of an animal with respiratory disease and hypoxemia with or without hypercarbia is planned.  
- Animals with hypercarbia and hypoxemia are probably hypoventilating and consideration should be given to increasing the animal's minute ventilation through relief of airway obstruction (e.g. by foreign bodies or bronchoconstriction),improvement in function of respiratory muscles (restore hydration, maintain normal blood concentration of electrolytes, including calcium), and positional adjustments (foals have better respiratory when in sternal recumbency).  
- Artificial ventilation should be considered, but is impractical for long-term treatment in animals other than those housed in referral centers. Ventilation/perfusion abnormalities cause hypoxemia with normal to only slightly elevated PaC02 in most affected animals.   
-Oxygen therapy can be useful in ameliorating or attenuating the hypoxemia due to ventilation/perfusion abnormalities.**

**OXYGEN THERAPY  
The principal treatment for hypoxemia caused by diseases of the lungs is the administration of oxygen.   
- Oxygen therapy is not often used in large animals in field situations but the use of a portable oxygen cylinder may find a place in tiding animals over a period of critical hypoxia until inflammatory lesions of the lungs subside. It has been used most often in valuable calves and foals.   
- Oxygen therapy must be given continuously, requires constant or frequent attendance on the animal, and can be expensive.  
- Supplemental oxygen is usually administered through a nasal cannula with the tip placed in the nasopharynx, through a mask or through a cannula inserted percutaneously in the trachea.  
- The use of an oxygen tent is impractical.   
- It is of no value when the hypoxia is due to toxins that interfere with oxygen metabolism in tissues (e.g.cyanide). – Oxygen therapy will only minimally increase oxygen transport in animals with anemia, abnormal hemoglobin (methemoglobinemia) or cardiovascular shock.  
- Cases of pneumonia, pleurisy, and edema and congestion of the lungs are most likely to benefit from provision of supplemental oxygen.  
 - Oxygen is often administered to newborn animals, either during resuscitation after birth or in those animals with respiratory disease.   
 - The value of supplemental oxygen in increasing P.o2 has been examined in foals, but the recommendations probably apply to newborns of other species as well.  
- Both a facemask and nasopharyngeal tube are effective**

**RESPIRATORY STIMULANTS  
- Use of respiratory stimulants, including doxapram, picrotoxin, leptazol (Metrazol) , nikethamide (Coramine) , caffeine and amfetamine sulfate, which has been advocated in the past, is not useful or recommended in animals with hypoxemia due to respiratory disease.  
- In these animalsthere is already maximal stimulation of  
the respiratory center and administration of drugs such as caffeine or doxapram is at best useless and at worst harmful, in that they can increase oxygen demand, in particular myocardial oxygen demand, thus exacerbating any oxygen deficit.  
 - The drugs might be useful in stimulating respiration in animals with pharmacological depression of the respiratory center by general anesthetics and sedatives.**

**MECHANICAL VENTILATION  
- Short-term mechanical ventilation can be achieved in neonates and small adults by use of a nasotracheal tube and a hand­operated bellows, which is usually in the form of a resilient bag equipped with a one-way valve.  
- The animal's trachea is intubated and the bag is connected and squeezed to supply a tidal volume of approximately 5-10 mLlkg BW at a rate of approximately 20 breaths per minute.  
- Commercial bags are available in a variety of sizes suitable for neonates and small ruminants. There is a simple device for respiratory resuscitation of newborn calves and lambs consisting of a mouthpiece, a nonreturn valve, a flange and an oral tube.  
- Ventilation of larger animals requires use of compressed gases and appropriate valving systems including a Hudson demand valve .**

**ANTI-INFLAMMATORY THERAPY  
- Many infectious and noninfectious diseases of the lower respiratory tract have inflammation as a major component of the tissue response to the initial insult.  
- Primarily inflammatory diseases include heave and inflammatory airway disease of horses.   
- Inflammation is an important component of pneumonia and some of the allergic or toxic lung diseases. Suppression of the inflammatory response is indicated when the inflammatory response is exacerbating clinical signs of the disease through obliteration of alveoli  
(inflammatory atelectasis), blockage of airways by inflammatory exudates and infiltration of bronchial walls, and bronchoconstriction as a consequence of inflammation increasing airway reactivity .**

**- Administration of anti -inflammatory drugs is indicated as the definitive therapy in noninfectious inflammatory airway disease (with control achieved by environmental controls) . Care must be taken that suppression of the  
inflammatory response does not impair innate and adaptive immune responses to infectious agents.  
- Anti-inflammatory drugs used in the treatment of diseases of the respiratory tract include glucocorticoids and non ­ steroidal anti –inflammatory drugs (NSAIDs), with other agents such as leukotriene antagonists, interferon and cromolyn sodium used in particular situations.  
Nonsteroidalanti-inflammatory drugs are useful in the treatment of infectious respiratory disease of cattle and horses, and likely other species.**

**- The drugs act by inhibiting the inflammatory response induced by the infecting organism and tissue necrosis. Meloxicam (0.5 mg/kg subcutaneously, once), when administered with tetracycline, improves weight gain and reduces the size of lesions in lungs of cattle with bovine respiratory disease complex over those of animals treated with tetracycline alone. NSAIDs also improve the clinical signs of cattle with respiratory disease. Use of these drugs is routine in horses with pneumonia or pleuritis.  
 - Glucocorticoids  
 are administered for control of inflammation in a variety inflammatory lung diseases but notably heaves of horses and interstitial pneumonia of foals.**

**-Treatment can be administered orally, by intravenous or intramuscular injection, or by inhalation. Oral, intramuscular or intravenous administration results in systemic effects of the agents.  
- Inhalation of glucocorticoids provides therapy directed to the site of the disease and minimizes, but does not always prevent, the systemic   effects of the drugs. Drugs for inhalation are usually human preparations of fluticasone, beclomethasone and flunisolide that are available as metered-dose inhalers. The compounds are administered through a mask adapted so that a large proportion of the drug is inhaled.   
- Anti-inflammatory responses in the airways are pronounced and result in marked improvement in respiratory function in horses with heaves.**

**IMMUNOMODULATORS  
Interferon is used for the treatment of inflammatory airway disease in race horses and feedlot cattle with respiratory disease. A dose of 50- 150 IU of interferon-alpha administered orally once daily for 5 days reduced signs of airway race horses. Immune stimulation byinjection of a suspension of inflammation in young Standard bred Propioni bacterium acnes has been investigated for treatment of chronic inflammatory airway disease in horses. The compound enhances expression of interferon-gamma and NK­lysin in peripheral blood mononuclear cells, increases the proportion of CD4+cells in peripheral blood and increases phagocytic activity of cells in peripheral blood.**

**ANTIMICROBIAL THERAPY  
- Bacterial infections of the respiratory tract of all species are treated with antimicrobial agents given parenterally or, less commonly, orally. Individual treatment is usually necessary and the duration of treatment will depend on the causative agent and the severity when treatment was begun.   
- In outbreaks of infectious respiratory disease the use of mass medication of the feed and water supplies may be advisable for the treatment of subacute cases and for convalescent therapy. The response to mass medication will depend on the total amount of the drug ingested by the animal and this is a reflection of the appetite or thirst of the animal, the palatability of the drug and its concentration in the feed or water.**

**-The choice of drug used will depend on its 1- cost, 2-previous experience on similar cases and 3- the results of drug sensitivity tests if available. The individual treatment of all in -contact animals in an affected group may be useful in controlling an outbreak of respiratory disease.  
Selection of antimicrobials: is based on principles. Briefly, antimicrobials for treatment of bacterial respiratory disease should be 1- active against the causative agent, 2- achieve therapeutic concentrations in diseased lung and 3- convenient to administer. 4-The antimicrobials should be affordable and, 5- if used in animals intended as human food, must be approved for use in such animals. Antimicrobials for treatment of lung disease are preferably those that achieve therapeutic concentrations in diseased lung tissue after administration of conventional doses.**

**This has been convincingly demonstrated for the macrolide (azithromycin,erythromycin, clarithromycin), triamilide (tulahromycin) and fluoroquinolone microbials and fluorfenicol in a variety of species. The beta-lactam antimicrobials(penicillin, ceftiofur) are effective in treatment of pneumonia in horses, pigs, and ruminants despite having chemical properties that do not favor their accumu1ation in lung tissue.   
- Routes of administration include oral(either individually or in medicated feed or water), parenteral (subcutaneous, intra­muscular, intravenous) or by inhalation. Intratracheal disease is administration effective of anti­of microbials to animals with respiratory not an means achieving therapeutic drug concentrations in diseased tissue.**

**- Aerosolization and (danofloxacin, enrofloxacin) antimicrobials has the theoretic advantage. of targeting therapy to the lungs and minimizing systemic exposure to the drug.  
- Aerosol administration of gentamicin to horses and ceftiofur sodium to calves with pneumonia has been investigated. Aerosl administration of gentamicin to normal horses results in gentamicin concetrations in bronchial lavage fluid 12 times that achieved after intravenous administration.   
- Aerosolized ceftiofur sodium (0.5 mg/kg s/c, once), when administered with tetracycline, improves weight gain and reduces the size of lesions in lungs of cattle with bovine respiratory disease complex over those of animals treated with tetracycline alone.**

**- NSAIDs also improve the clinical signs of cattle with  
respiratory disease. The use of these drugs is routine in horses with pneumonia or pleuritis. (1 mg/kg) is superior to intramuscular administration in treatment of calves with Pasteurella (Mannheimia) haemolytica.   
BRONCHODI LATOR DRUGS  
Bronchoconstriction component of the is an important airway increased resistance present in many animals with disease of the lower respiratory tract.   
- Administration of bronchodilators can relieve respiratory distress and improve arterial blood oxygenation. Bronchodilatory drugs are beta-2-agonists (clenbuterol, albuterol/salbutamol, terbutaline), parasympatholytic drugs (ipratropium, atropine) and methylxanthines (aminophylline, theophylline) .**

**-The indication for the use of bronchodilators is relief of bronchoconstriction. Bronchoconstriction is an important component of the pathophysiology of many diseases of the lungs and airways.  
- Bronchodilators are used extensively in horses with heaves and inflammatory airway disease, and less so in animals with infectious diseases.  
-Contraindications are few but caution should be exercised when using these drugs in animals that are severely hypoxemic as the beta-2-agonists can transiently worsen gas exchange by increasing perfusion of non ventilated sections of the lung, and in pregnant animals, in which the tocolytic effect of the beta-2-agonists can delay parturition.**

**MUCOLYTICS. MUCOKINETIC AND ANTITUSSIVE DRUGS  
Many groups of drugs are used in the therapy of respiratory diseases with the objective of improving mucokinesis or effective mucociliary clearance.  
1 - Mucokinetic agents have been divided into six groups according to their mode of action.  
2- Diluents, surface acting agents and mucolytics are supposed to reduce the viscosity of the respiratory secretions O2  
3 - Bronchomucotropic agents, formerly called expectorants, are supposed to increase the prosduction of a less viscous mucus.  
 Other agents, such as beta-adrenergic agonists and methylxanthine derivatives, promote more effective clearance of mucus and act as ciliary augmentors or bronchodilators.  
4- Hyperhydration, the administration of large quantities of fluids intravenously,  
5- Bronchomucotropic agents (expectorants) are administered with the intention of augmenting the volume of respiratory secretions by stimulating the mucus-producing cells and glands.  
6- Antitussive (cough suppressant) drugs are infrequently used in large-animal medicine. the mucus-producing cells and glands.**

**SURFACTANT  
- Surfactant is critical to normal alveolar function and a lack of this complex phospholipid results in progressive alveolar collapse.  
 - Lack of surfactant is an important cause of respiratory disease in newborn animals, with those born prematurely being at increased risk.  
- Attempts have been made to prevent acute respiratory disease in premature newborn foals, such as those delivered by cesarian section because of maternal disease, but the results have been disappointing.**

**SURGERY  
Many conditions of the upper respiratorytract of horses are amenable to surgical correction. Tracheostomy is often used in the emergency or urgent relief of acute upper airway obstruction, and in the removal of large amounts of tracheal debris, such as occurs in animals with smoke inhalation.   
GEN ERAL NURSING CARE  
- One of the most important aspects of the treatment of respiratory tract disease in farm animals is the provision of a comfortable, well-ventilated environment during and after the disease episode.  
- Affected animals should be placed · in a draft-free area that is adequately ventilated and supplied with an abundance of bedding for comfort and warmth, particularly during convalescence.  
- Feed and water should be readily available and dusty feeds avoided.**

**CONTROL OF RESPIRATORY DISEASE  
Infectious diseases of the respiratory tract of farm animals are caused by a combination of infectious agents and pre­ disposing causes, such as inclement weather, the stress of weaning, or transportation and poorly ventilated housing, each of which can weaken the defense mechanisms of the animal.   
Prevention and control of these diseases include :  
1- Minimizing exposure to inciting agents (infectious or physical).  
2- Maximizing innate resistance by ensuring that the animals are in excellent general health through attention to nutrition, housing and animal welfare .  
3- Maximizing adaptive resistance by the administration of effective vaccines such that maximal resistance is produced to coincide with the time of greatest risk of the disease.  
IMPORTANCE OF DIAGNOSIS  
- For some complex respiratory diseases of food animals it is becoming increasingly more difficult to obtain a definitive etiological diagnosis because some of the common diseases appear to be caused by multiple infections rather than a single one.  
- Most of the infective agents that cause respiratory disease are ubiquitous in the environment and are present as normal residents in the nasal cavities of normal animals. This often creates difficulty with the interpretation of the microbiological findings in outbreaks of respiratory disease because the infectious agents can commonly be isolated from both sick and well animals.**

**- Thus there may be no well-defined cause-and-effect relationship and the predisposing causes begin to assume major importance in any control program.**

**MANAGEMENT TECHNIQUES  
 Successful control will depend on the use of management techniques before the disease is likely to occur. For example, in beef cattle, pneumonic pasteurellosis can be kept to a minimum stress with the use of certain of management procedures that minimize at weaning.   
 HOUSING FACILITIES  
- Cattle barns that are overcrowded, damp and cold during the cold winter months and hot and stuffy during the summer months can predispose to a high incidence of pneumonia. The morbidity and mortality from pneumonia may be much higher when the ammonia concentration of the air is high or if it is dusty.  
- The incidence of pulmonary inflammation and coughing (heaves) in horses is much higher in those that are housed in barns that are dusty and not ventilated.**

**VACCINES  
Vaccines are available for the immunization of farm animals against some of the common infectious diseases of the respiratory tract. Their advantages and disadvantages are discussed under each specific disease.  
 ENVIRONMENTAL CONTROL  
In effect, the principles of control and prevention of airborne respiratory disease are based largely on keeping the levels of pathogens in the air at a low level. This can be accomplished by a combination of the following practices:  
1- The use of filtered-air positive pressure ventilation systems.  
2- The removal of affected animals from the group  
3- Increasing the ventilation rate of the building unit.**

**4-Subdivision of the unit into small units, each with its own ventilation system.  
5 -A continual disinfection system where appropriate and practicable.  
6- The provision of supplemental heat so that during cold weather the ventilation can be maintained and animals will not huddle together to keep warm and thereby increase the exposure rate of infection  
7- The use of vaccines for specific diseases of the respiratory tract  
8- Effective dust control.**

**References**

**O. M. Radostits, C.C.Gay, K. W. Hinchcliff, and P. D. Constable ( 2011 ): VETERINARY MEDICINE**

**A textbook of the diseases of cattle, horses, sheep, pigs and goats,10thedition. Publisher SAUNDERS. www.elsevierhealth.com**