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β-Adrenergic Agonists

The β-adrenergic agonists have beneficial effects in the treatment of bronchoconstrictive respiratory tract diseases. Bronchial smooth muscle is innervated by β_2-adrenergic receptors. Stimulation of these receptors leads to increased activity of the enzyme adenylate cyclase, increased cyclic AMP, and relaxation of bronchial smooth muscle. Stimulation of β receptors on mast cells decreases the release of inflammatory mediators from mast cells, but other inflammatory cells are not suppressed. There is some evidence that β-adrenergic receptor agonists increase mucociliary clearance in the respiratory tract. For dosages, *see* *Table: β-Adrenergic Receptor Agonist Drugs* .

Epinephrine (adrenaline) stimulates α and β receptors, producing pronounced vasopressive and cardiac effects in addition to bronchodilation. Epinephrine is reserved for emergency treatment of life-threatening bronchoconstriction (eg, anaphylaxis). The nonspecific stimulation of other receptors and its short duration of action make it unsuitable for long-term use. Epinephrine is available as a 1 mg/mL solution. Its onset of action is immediate, and the duration of effect is 1-3 hr.

Isoproterenol is a potent β-receptor agonist. It is selective for β receptors, but cardiac (β_1) effects make it unsuitable for long-term use. It is administered by inhalation or injection and has a short duration of action (<1 hr). For emergency relief of bronchoconstriction in horses, it is given by slow IV solution at a dilution of 0.2 mg/50 mL of saline. Administration is discontinued when the heart rate doubles.

Terbutaline is similar to isoproterenol in its β_2 activity but has little β_1 activity at usual doses. It has a longer duration of action (6-8 hr) than isoproterenol. It may be injected SC to relieve an acute episode of bronchoconstriction. It should not be used in animals with feline hypertrophic cardiomyopathy or glaucoma. It should be used with caution in animals with cardiac or renal disease, diabetes mellitus, or hyperthyroidism. Terbutaline may cause sweating and CNS excitement when administered IV to horses. It may be used concurrently with methylxanthine bronchodilators. Albuterol (salbutamol) is similar to terbutaline and is used in dogs and horses.

Clenbuterol is commonly used in some countries in the treatment of chronic obstructive pulmonary disease (COPD) in horses. Results of efficacy studies have been conflicting, but clenbuterol appears to have a significant effect on increasing mucociliary transport in horses with COPD. The dosage is increased gradually until a satisfactory clinical response is seen. If at the highest recommended dose there is no response, the horse is considered to have irreversible bronchospasm. The most common adverse effects are tachycardia and muscle tremors. Clenbuterol also inhibits uterine contractions, so should be used during late pregnancy only if this effect is desired for obstetrical manipulations. Clenbuterol is not available in the USA because of concerns over use in food animals. Clenbuterol is a repartitioning agent; it directs nutrients away from adipose tissue and toward muscle. The result is increased carcass weight, increased ratio of muscle to fat, and increased feed efficiency. There is a significant human health risk from clenbuterol residues in food animals.

Because the systemic administration of bronchodilators can be associated with undesirable side effects, methods have been developed to administer the β-adrenergic receptor agonists, glucocorticoids, and anticholinergic drugs by nebulization or metered-dose inhaler. An aerosol chamber system has been designed for using human metered dose inhalers in horses with COPD. The metered dose inhaler system is six times as efficient as nebulization. When a β-adrenergic receptor agonist aerosol is used in conjunction with a glucocorticoid or anticholinergic aerosol, it should be administered 5 min before the glucocorticoid or anticholinergic drug. This allows for bronchodilation to occur and results in increased deposition of the glucocorticoid or anticholinergic drug in the bronchi. The β agonists that are administered with metered dose inhaler systems to horses include albuterol, epinephrine, fenoterol, isoetharine, isoproterenol, metaproterenol, pirbuterol, and terbutaline.

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