

Anticholinergics in Dogs and Cats



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Background and Pharmacology

Anticholinergics, also known as *antimuscarinics*, have long been used to treat and prevent bradycardia during the anesthetic period (Figure 1). Atropine and glycopyrrolate are the two most commonly used drugs of this class within veterinary medicine. More often than not, anesthetic bradycardia is due to drug effects or vagally-mediated processes. In determining whether or not to include and/or administer an anticholinergic as part of a premed or in response to bradycardia during the anesthetic period, one needs to consider certain patient factors and consider other concurrently administered drugs.



Anticholinergics' primary mechanism of action is to act as parasympatholytics in that they competitively block acetylcholine from acting as a neurotransmitter at muscarinic receptors. There are five muscarinic receptor subtypes, but the M₂ receptor plays the largest role in heart rate (HR) maintenance given its location in the sinoatrial and atrioventricular nodes of the heart.^{1,2} Other known effects of anticholinergics include bronchodilation, decreased salivation and airway secretions, mydriasis (higher likelihood after topical administration), and gastrointestinal effects (e.g., reduced lower esophageal sphincter tone, which can increase the risk of gastroesophageal reflux and aspiration).^{1,2} These other effects are due to muscarinic receptor binding in different tissues throughout the body.

Indications, Contraindications, and Dosing Information

There are a few absolute indications for anticholinergic administration in a premedication. These include neonatal and pediatric patients (those \leq 3-4 months in which cardiac output (CO) is dependent on HR), patients with low resting HR due to cardiac conduction disturbances, systemic disease, or high resting vagal tone, and lastly, patients with advanced degenerative valvular disease as bradycardia increases filling time and increases regurgitation.

The absolute contraindications for anticholinergics in premeds include patients with underlying tachydysrhythmias, patients with hypertrophic or other restrictive cardiomyopathies in which CO decreases with reduced filling time/reduced stroke volume, and hyperreflexic patients.

In following with the indications and contraindications, there are a few hazy areas regarding to anticholinergic use.

1. Many commonly used premedications cause bradycardia as a side effect (e.g., opioids and alpha-2 adrenergic agonists), which can be significant in the anesthetized patient. If a patient was given an alpha-2 agonist, one needs to determine if the bradycardia is reflexive due to peripheral vasoconstriction (early drug effect) or due to the delayed sympatholytic effect of the drug (bradycardia *and* hypotension present).^{1,2,3,4,5} An increase in HR while peripherally vasoconstricted dramatically increases workload on the heart and myocardial oxygen demands. No study has shown a benefit to co-administration of an anticholinergic and alpha-2 agonist. In healthy dogs, this co-administration often results in arrhythmias and significant hypertension.^{3,4,5} If a patient was given an alpha-2 agonist and is later bradycardic and hypotensive, the author recommends treatment with an anticholinergic if >45 -60 minutes out from the time of premedication. If the patient is bradycardic and hypertensive, the author recommends reversing the alpha-2 agonist via an intramuscular route before giving an anticholinergic.
2. In patients undergoing enucleation for underlying ocular disease, the oculovagal reflex is a common concern. Interestingly, in a single study in dogs undergoing enucleation, those given a preoperative retrobulbar nerve block were *less likely* to have an oculocardiac reflex than those given pre-operative anticholinergic drugs.⁶ This indicates that the reflex is likely blunted with adequate analgesia, but should bradycardia occur, either removing the stimulus (surgery) or administering an anticholinergic are reasonable alternatives.
3. Historically, atropine or glycopyrrolate have been recommended as commonplace in anesthetic management of patients undergoing cesarean section, likely to inhibit vagal tone associated with manipulation of the uterus and increase maternal/fetal HRs.^{1,2} However, given the reduction in lower esophageal sphincter tone and decreased gastric motility in patients already at increased risk of regurgitation and aspiration, the author cautions the inclusion of anticholinergics as standard of care in these patients.

As an overriding rule, the author recommends more common use of anticholinergics *as needed* in anesthetized patients to maintain HR in a normal range, helping to preserve blood pressure and cardiac output. It is advisable as part of the anesthetic protocol or record to have an emergency dose of atropine calculated and access to anticholinergics within a reasonable distance. In the face of non-life-threatening

drops in HR, the author recommends starting with lower doses of anticholinergic, knowing you can always supplement more if HR does not sufficiently increase (Table 1). The effects of tachycardia, while short-lived, can be more detrimental to the anesthetized patient.

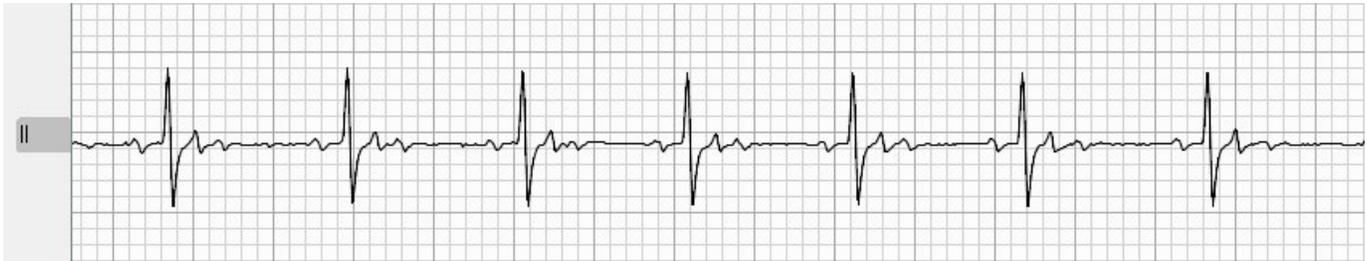


Figure 1. Second degree AV block with 2:1 conduction and HR of 60 bpm. There is a repeating PR interval, but each QRS is followed by a non-conducted P wave. Sinus bradycardia and first/second degree AV block are the most commonly treated anesthetic bradyarrhythmias.

| Drug | Dose* | Onset of Action | Duration of Action | Crosses Blood-Brain-Barrier |
|----------------|--|--|---|-----------------------------|
| Atropine | 0.015-0.02 mg/kg IM and IV 0.04 mg/kg IV (CPR) <i>Increase dose 2-3X if giving via intra-tracheal route during CPR</i> | 1 minute (IV) 10-20 minutes (IM) | 30 minutes (IV) 60-90 minutes (IM) | Yes |
| Glycopyrrolate | 0.005-0.01 mg/kg IM and IV | Up to 5 minutes (IV) 30-45 minutes (IM) | Up to 1 hour (IV) 60-90 minutes (IM) | No |

Table 1: Atropine vs. glycopyrrolate – drug effects on the cardiovascular system similar in dogs and cats

*Depending on the dose of anticholinergic given, it is not uncommon to see a worsening of the bradycardia before HR increases. This is thought to be due to blockade of presynaptic M₁ receptors that normally inhibit acetylcholine release. HR should increase within 5-10 minutes, but if the effects of the bradycardia cannot be tolerated, a second smaller dose of the same anticholinergic can be given to initiate M₂ receptor blockade.^{1,2}

References

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