

# COMPLETE HEART BLOCK (THIRD-DEGREE ATRIOVENTRICULAR BLOCK)

## BASICS

### OVERVIEW

- The heart of the dog or cat is composed of four chambers; the top two chambers are the right and left atria and the bottom two chambers are the right and left ventricles
- In order to pump blood to the lungs and body, the heart must work in a coordinated fashion; the normal control or “pacemaker” of the heart is the sinoatrial (SA) node, which starts the electrical impulse to begin the coordinated contraction of the heart muscles—the electrical impulse causes the atria to contract, pumping blood into the ventricles; the electrical impulse moves through the atrioventricular (AV) node and into the ventricles, causing the ventricles to contract and to pump blood to the lungs (right ventricle) and the body (left ventricle)
- The normal heart rate for dogs varies based on the size of the dog; however, the general range is 60 to 180 beats per minute (with smaller dogs have faster normal heart rates)
- The general range for normal heart rate in cats is 120 to 240 beats per minute
- An electrocardiogram (“ECG”) is a recording of the electrical impulse activity of the heart; the normal ECG is a tracing with P, QRS, and T waves; the P waves are the first upward deflection of the ECG tracing that look like a “bump” in the tracing; the P waves are a measure of the electrical activity of the atria; the QRS looks like an exaggerated “W” with the Q wave being a short, downward deflection, the R being a tall, spiked upward deflection, and the S being another short, downward deflection; the QRS is a measure of the electrical activity of the ventricles; finally the T wave may be an upward or downward deflection of the ECG tracing; the T wave is a measure of ventricular recovery prior to the next contraction
- “Complete heart block” or “third-degree atrioventricular block” occurs when all atrial impulses are blocked at the atrioventricular (AV) node; therefore, the atria and ventricles beat independently and are no longer beating in a coordinated fashion—a secondary “escape” pacemaker site (either near the AV node or in the ventricle) stimulates the ventricles
- The atrial rate is normal (that is, the normal pacemaker or sinoatrial node starts the electrical impulse to begin at a normal rate, which causes the atria to contract at a normal rate)
- The ventricular rate (known as an “idioventricular escape rhythm”) is slow

### ECG Features

- Ventricular rate slower than the atrial rate (that is, more P waves are present than are QRS complexes)—ventricular escape rhythm (idioventricular) usually less than 40 beats per minute; junctional (near the atrioventricular node) escape rhythm (idiojunctional) 40 to 60 beats per minute in dogs and 60 to 100 beats per minute in cats
- P waves—usually normal appearance
- QRS complex—may be wide and bizarre or normal, depending on location of the secondary “escape” pacemaker
- No conduction occurs between the atria and the ventricles; P waves have no constant relationship with QRS complexes

### GENETICS

- Can be an isolated congenital (present at birth) defect

### SIGNALMENT/DESCRIPTION of ANIMAL

#### Species

- Dogs and cats

#### Breed Predispositions

- Cocker spaniels—can have scarring of heart tissue of unknown cause (so called idiopathic fibrosis”)
- Pugs and Doberman pinschers—can have associated sudden death, defects in conduction of impulses from the atria to the ventricles (known as “atrioventricular conduction defects”), and lesions in the specialized heart tissue (known as the “bundle of His”) that conducts electrical impulses into the ventricles

#### Mean Age and Range

- Senior animals, except congenital (present at birth) heart disease patients
- Median age for cats is 14 years

#### Predominant Sex

- Intact female dogs

### SIGNS/OBSERVED CHANGES in the ANIMAL

- Exercise intolerance
- Weakness or fainting (known as “syncope”)
- Occasionally, congestive heart failure (condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs)
- Slow heart rate (known as “bradycardia”)
- Change in heart sounds, when listening to the heart with a stethoscope (known as “auscultation”)

- Coughing and difficulty breathing (known as “dyspnea”)

### CAUSES AND RISK FACTORS

- Isolated congenital (present at birth) defect
- Scarring of heart tissue of unknown cause (idiopathic fibrosis)
- Heart-muscle disease caused by infiltration with abnormal substance or cancer (known as “infiltrative cardiomyopathy”); example of disease with infiltration by an abnormal substance is amyloidosis (condition in which insoluble proteins [amyloid] are deposited outside the cells in the heart and various organs, compromising their normal function)
- Hypertrophic cardiomyopathy (disease characterized by inappropriate enlargement or thickening of the heart muscle of the left ventricle) in cats
- Digitalis toxicity; “digitalis” is a heart medication
- Inflammation of the heart muscle (known as “myocarditis”)
- Inflammation of the lining of the heart (known as “endocarditis”)
- Electrolyte disorder
- Sudden lack of blood supply to the heart muscle that leads to death of tissues (known as “myocardial infarction”)
- Other congenital (present at birth) heart defects
- Lyme disease (tick-borne disease, caused by *Borrelia burgdorferi*)
- Chagas’ disease (disease caused by a parasite, *Trypanosoma*, that damages heart muscle)

## TREATMENT

### HEALTH CARE

- Temporary or permanent heart pacemaker—only effective treatment in patients with clinical signs
- Cage rest prior to pacemaker implantation; when the pulse generator of the pacemaker is placed surgically into a pocket under the skin (known as a “subcutaneous pocket”), a nonconstrictive bandage is required for 3 to 5 days to prevent formation of a localized accumulation of serum (known as a “seroma”) or pacemaker movement

### ACTIVITY

- Restrict, if animal has clinical signs
- Cage rest prior to pacemaker implantation

### DIET

- No modifications, unless required for management of underlying condition (for example, a low-salt diet)

### SURGERY

- Most patients—at high risk for undergoing surgery; heart rate usually paced preoperatively with a temporary external pacemaker system
- The small size of cats makes pacemaker implantation more difficult than in dogs

## MEDICATIONS

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

- Treatment with drugs—usually of no value
- Medications traditionally used to treat complete heart block (complete atrioventricular block): atropine, isoproterenol, theophylline, steroids, and dobutamine
- Intravenous isoproterenol infusion may help increase the ventricular rate to stabilize circulation of blood
- If animal has signs of congestive heart failure (condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs)—medications to remove excess fluid build-up (known as “diuretics”) and to enlarge or dilate blood vessels (known as “vasodilator therapy”) may be needed before pacemaker implantation

## FOLLOW-UP CARE

### PATIENT MONITORING

- Monitor—pacemaker function with serial electrocardiograms (“ECGs,” recordings of the electrical activity of the heart)
- Chest X-rays—following pacemaker implantation, to confirm the position of the lead and generator
- Carefully monitor patients that do not have clinical signs and have not had a pacemaker implanted for development of clinical signs

### POSSIBLE COMPLICATIONS

- Pulse generators—broad range of clinical life; pacemaker replacement necessary when battery is depleted, pulse generator malfunction occurs, or exit block develops
- Pacemaker leads can become dislodged and infected

#### **EXPECTED COURSE AND PROGNOSIS**

- Poor long-term prognosis, if no heart pacemaker is implanted, especially when the animal has clinical signs
- Cats can sometimes survive more than one year without having a pacemaker implanted

#### **KEY POINTS**

- Temporary or permanent heart pacemaker—only effective treatment in patients with clinical signs of complete heart block (third-degree atrioventricular block)
- Patients without clinical signs and that have not had a pacemaker implanted must be monitored carefully for development of clinical signs

