



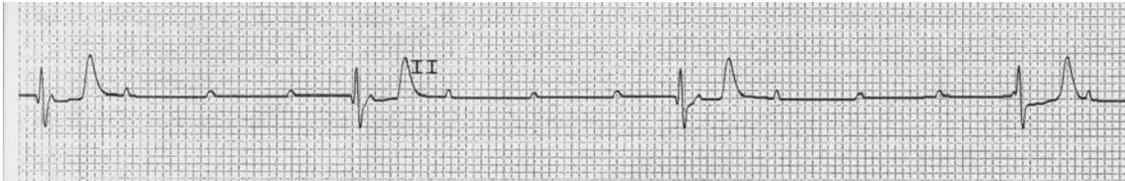
Animal Specialty Hospital of Florida

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Pacemaker Implantation in Dogs and Cats:

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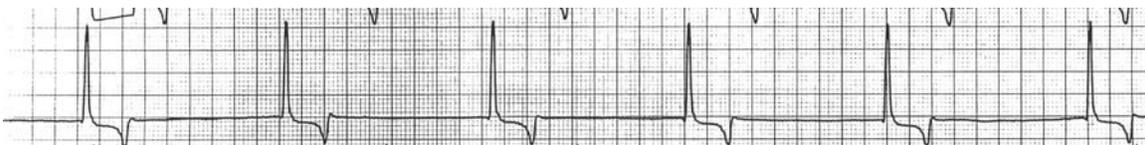
Patients that have symptomatic bradycardia (slow heart rates) may benefit from the placement of a permanent artificial pacemaker. This is most commonly performed in dogs suffering from electrical heart disease with arrhythmias such as **atrioventricular (AV) block** or **sick sinus syndrome**. Occasionally, dogs are paced for atrial standstill. Cats rarely require artificial pacing, but if they do, it's usually because they have AV block. These arrhythmias cause the heart to beat very slowly. Patients may have symptoms including lethargy, weakness and even collapse or fainting (syncope). Patients with long-term bradycardia may even develop secondary congestive heart failure.



EKG of a dog with third degree AV block. An escape rhythm is present and the atria are beating independently of the ventricles.



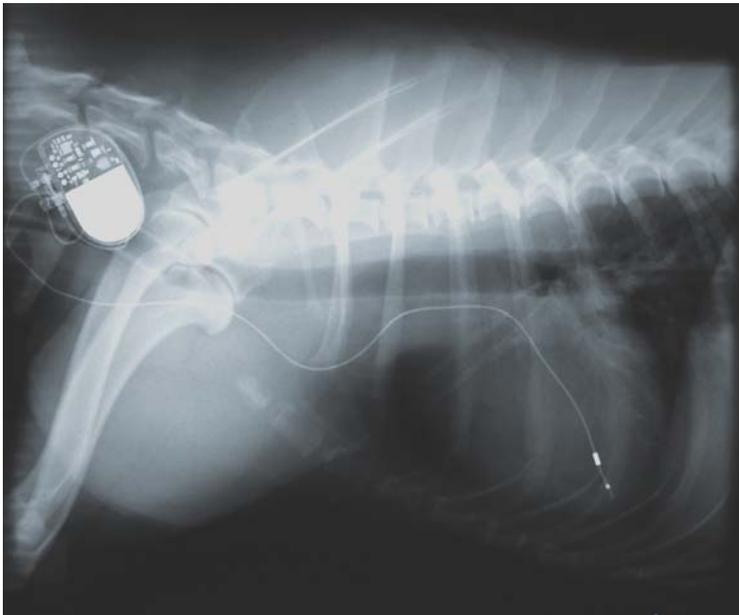
EKG of a dog with sick sinus syndrome. The heart suddenly stops and is rescued by an escape rhythm.



EKG of a dog with atrial standstill. An escape rhythm is present and no atrial activity is evident.

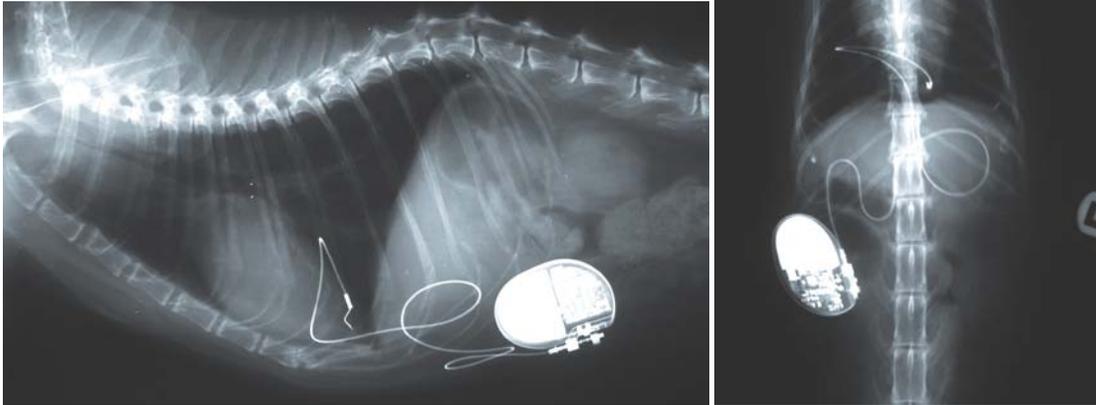
Candidates for artificial pacing ideally have no to minimal underlying structural heart disease. Patients that have severe heart disease, intracardiac tumors or other life-limiting medical conditions are not generally considered good candidates for pacing, as their long-term prognosis may be poor. The veterinary cardiologist is the best person to evaluate a patient for potential pacemaker implantation. Patients should have complete bloodwork, urinalysis, thoracic and abdominal radiographs (x-rays), echocardiography, 6-lead EKG, and blood pressure evaluation at a minimum. Tick serology and abdominal ultrasound may also be recommended.

Most dogs are able to be paced via a procedure known as **transvenous pacemaker implantation**. In this procedure, the generator (battery) is placed under the muscle in the side of the neck, and the lead extends through a jugular vein all the way into the right side of the heart. The tip is situated in the right ventricular apex, where it contacts the inside of the heart muscle. The generator delivers pulses of electricity down the lead that stimulates the heart muscle to contract. Pacemakers may be programmed many different ways, and we typically set them up to be able to pace the heart over a range of heart rates depending on the patient's activity.

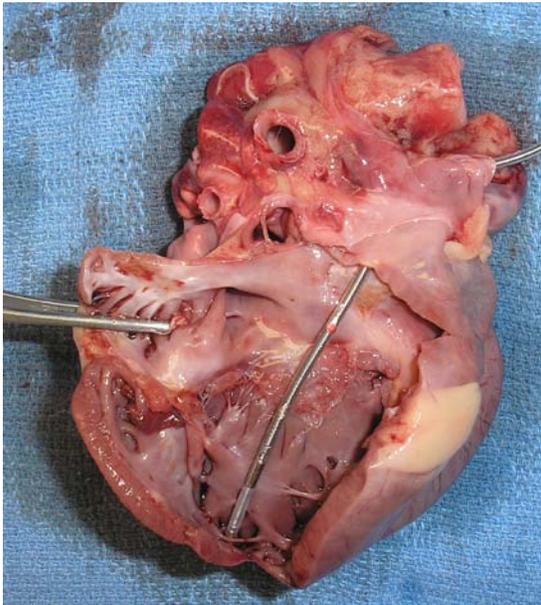


Radiograph of a Miniature Schnauzer following implantation of a transvenous pacemaker for SSS. The generator is located in a pocket in the superficial musculature in the neck, and the lead travels through the right jugular vein into the apex of the right ventricle of the heart.

Cats are unable to be paced using the same approach that we use in most dogs. Typically, the generator must be placed within the abdomen, and the lead is actually surgically attached to the apex (**epicardial** placement on the surface) of the heart from the outside through an incision in the diaphragm. The veterinary surgeon typically places these pacemakers often with the assistance of the veterinary cardiologist.



Radiographs from a cat paced for third degree AVB. An epicardial lead was implanted transdiaphragmatically, and the generator was implanted in a muscle pocket within the abdominal cavity.



Gross specimen from a dog that was paced. The right side of the heart has been opened, exposing the lead. The tip of the lead is ensnared in the ridges called *trabeculae* in the right ventricle.

The prognosis for patients that are successfully paced is generally good. Many patients live for years with implanted pacemakers. Periodic follow-up examinations are recommended. The pacemakers are able to be interrogated with the temporary placement of an external magnet and a computer. Patients do not need to have sedation or anesthesia for interrogation, and information regarding the battery life is obtained. We are also able to adjust the pacemaker as needed. Interrogation is recommended at least every six months.