



What Is Your Diagnosis?

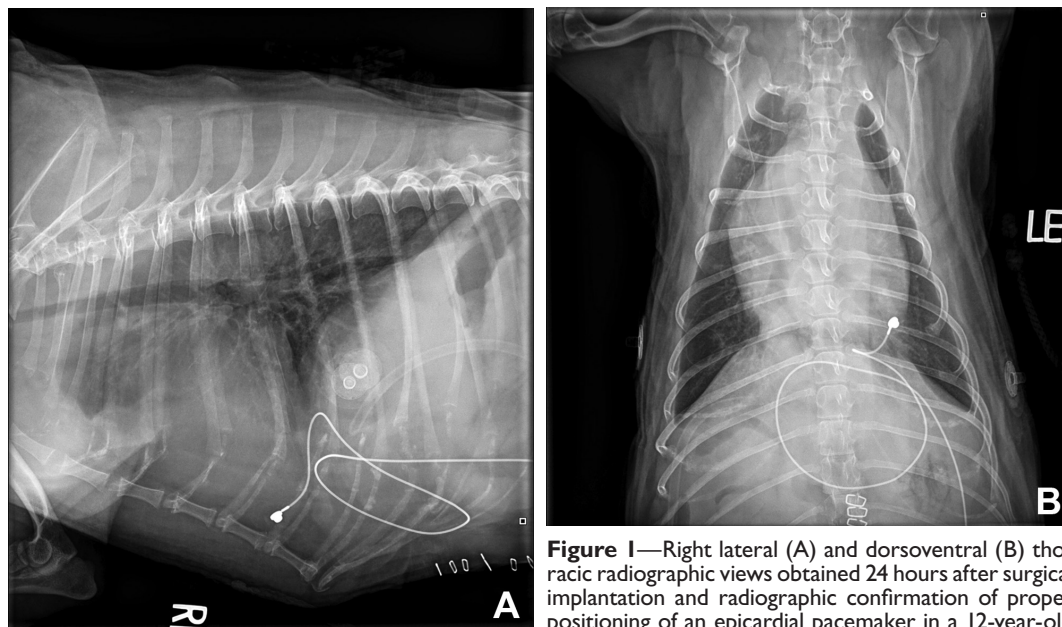


Figure 1—Right lateral (A) and dorsoventral (B) thoracic radiographic views obtained 24 hours after surgical implantation and radiographic confirmation of proper positioning of an epicardial pacemaker in a 12-year-old 7.5-kg (16.5-lb) spayed female Shih Tzu that continued to have syncopal episodes after receiving the pacemaker.

History

A 12-year-old 7.5-kg (16.5-lb) spayed female Shih Tzu was evaluated because it had 3 syncopal episodes within a 24-hour period. The dog had had a single syncopal episode 1 year previously but recovered immediately. The dog's veterinary records indicated that a previous diagnosis of subclinical hypercalcemia secondary to hyperparathyroidism had been made but that the dog was otherwise healthy.

On initial examination, the dog was bright, alert, and responsive, and the only abnormal clinical findings on physical examination were bradycardia and a grade 3 to 4 heart murmur heard loudest over the left apex of the heart. Initial database included a CBC, serum biochemical profile, urinalysis, echocardiography, and static ECG. Results of the CBC, serum biochemical profile, and urinalysis were unremarkable, except for mildly high serum calcium concentration (12.4 mg/dL; reference range, 7.9 to 12 mg/dL). Echocardiography revealed degenerative changes to the mitral valve leaflets, consistent with stage b1 endocardiosis,¹ but no left atrial enlargement or other abnormalities. Static ECG revealed a high-grade (advanced) second-degree AV block. Hyoscyamine sulfate (0.020 mg/kg [0.009 mg/lb], PO, q 12 h) was prescribed. The dog had no syncopal episodes for 4 months, but then had multiple syncopal episodes per day for several days, including 2 on the day the dog was returned for a recheck examination. The frequency of hyoscyamine administration was increased from every 12 hours to every 8 hours; however, the dog developed gastrointestinal signs, including vomiting. Therefore, the frequency of hyoscyamine administration was returned to twice daily, and the dog's gastrointestinal signs resolved. To regain chronotropic support and eliminate the syncopal episodes, treatment with albuterol (0.03 mg/kg [0.01 mg/lb], PO, q 12 h) was added. However, syncopal episodes continued, and an artificial pacemaker was recommended. A unipolar epicardial pacemaker was surgically placed at the apex of the heart, and immediately after surgery, correct cardiac pacemaker placement was verified with thoracic radiography (not shown). The metal opacity of the wire of the permanent epicardial pacemaker was superimposed with the abdomen, and the round button electrode component of the epicardial implant was visibly in contact with the apex of the heart.

During hospitalization, the dog again began to have syncopal episodes. Repeated static ECG revealed episodic failure to capture, which indicated that the pacemaker stimulus failed to cause myocardial depolarization. Follow-up thoracic radiographs were obtained (**Figure 1**).

Determine whether additional imaging studies are required, or make your diagnosis from Figure 1—then turn the page →

This report was submitted by Sara E. Wilkes, BS; David S. Biller, DVM; Evan S. Ross, DVM; Kara A. Berke, DVM; and Justin D. Thomason, DVM; from the Department of Clinical Sciences, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506. Ms. Wilkes was a third-year veterinary student at the time of the report.

Address correspondence to Ms. Wilkes (swilkes3@vet.k-state.edu).

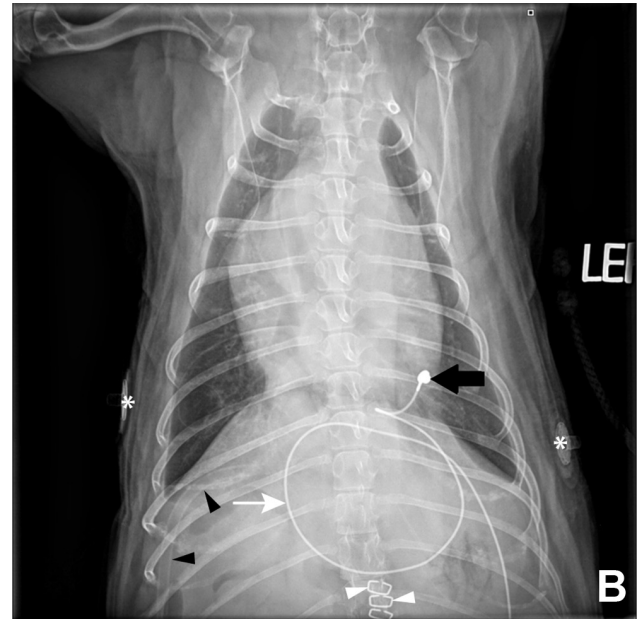
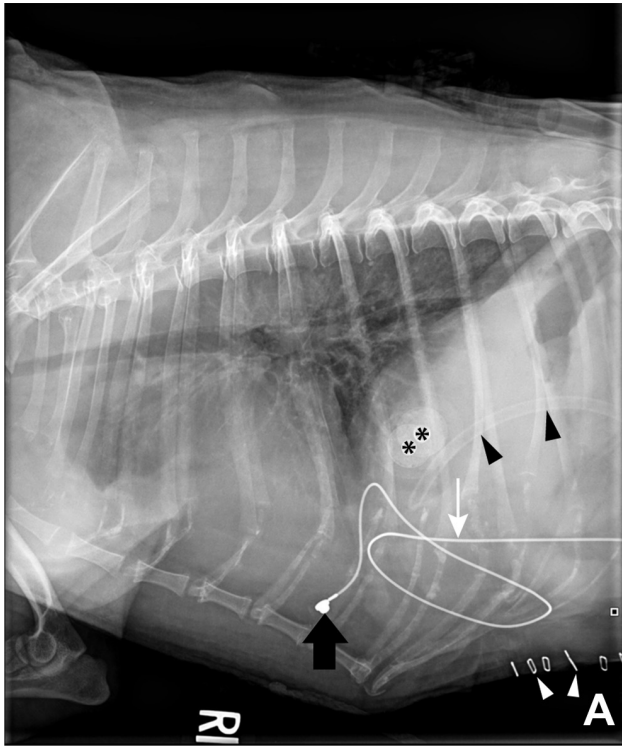


Figure 2—Same radiographic images as Figure 1. The button electrode component of the pacemaker (black arrow; A and B) at the end of the pacemaker wire (white arrow; A and B) is rotated 180° away from direct contact with the epicardial surface. Also visible are 2 ECG electrode stickers (asterisks; A and B) on the skin of the dog's thorax, a chest tube (black arrowheads; A and B), and skin staples (white arrowheads; A and B).

Radiographic Findings and Interpretation

The epicardial pacemaker lead wire was superimposed with the abdomen in proper position; however, the epicardial electrode component of the implant was improperly positioned (**Figure 2**). Rather than maintaining contact with the apex of the cardiac silhouette, the button electrode portion of the implant appeared to have rotated 180° away from the proper position, which ultimately caused failure of pacemaker function (loss of capture).

Treatment and Outcome

A temporary jugular pacemaker was placed in the dog to control syncopal episodes until corrective surgery for the epicardial implant could be performed. Two days later, the dog underwent surgery to reposition the electrode component of the pacemaker to be in contact with the heart and to tighten the component in place with 3-0 polypropylene suture.³ The dog has had no further syncopal episodes. Results of static ECG performed 1 month after surgery indicated proper pacemaker function, with a heart rate of 90 beats/min and a paced ventricular rhythm.

Discussion

Pacemaker implantation has become a common procedure in dogs with second-degree or complete atrioventricular block, and it is imperative to recognize common complications that may arise. In addition, radiography is critical to the evaluation of

proper pacemaker placement, regardless of the pacemaker system used.

A 2001 study² shows that complications following artificial pacemaker placement occurred in 84 of 152 (55%) dogs and that lead displacement and generator failure were the most common causes of failure, regardless of pacemaker system used. The same study² also shows that there was no significant difference in major complication rates between dogs that received transvenous pacemakers (46/136 [34%]) and dogs that received epicardial pacemakers (5/18 [28%]). Further, another study¹ shows that regardless of whether transvenous or epicardial pacemakers were used, 31 of 154 (20%) dogs with pacemaker complications required a corrective second procedure, as was the case in the dog of the present report.

A 2013 study³ shows the prevalence of pacemaker lead dislodgement was greater in dogs weighing > 10 kg (22 lb), compared with dogs weighing less. That finding, combined with the owner's concern about postsurgical activity restriction for the dog in the present report, was considered in our decision to use an epicardial pacemaker in the dog. Radiographically, proper epicardial pacemaker placement requires assessment of pulse generator position and electrode contact with the cardiac silhouette, not just the lead wire position as is the case with transvenous pacemakers. This was performed immediately after pacemaker implantation in the dog of the present report; however, after the dog later had syncopal episodes, we used radiography to help identify the underlying problem. It

is imperative that veterinarians treating animals with pacemakers be able to perform radiographic examinations and recognize radiographic evidence of potential causes of pacemaker failure to rapidly diagnose and correct malalignment if it occurs.

Footnotes

- a. Prolene, Ethicon US LLC, Vista, Ariz.

References

1. Atkins C, Bonagura J, Ettinger S, et al. Guidelines for the diagnosis and treatment of canine chronic valvular heart disease. *J Vet Intern Med* 2009;23:1142-1150.
2. Oyama MA, Sisson D, Lehmkuhl LB. Practices and outcome of artificial cardiac pacing in 154 dogs. *J Vet Intern Med* 2001;15:229-239.
3. Visser LC, Keene BW, Mathews KG, et al. Outcomes and complications associated with epicardial pacemakers in 28 dogs and 5 cats. *Vet Surg* 2013;42:544-550.