10 • Intraventricular conduction defects

Having understood the ECG leads and mean electrical axis, we can now explain abnormalities due to intraventricular conduction defects (aka ventricular aberrancy).

The bundle of His divides into left and right bundle branches, supplying the left and right ventricles respectively (see Fig. 2.1 page 4). The left bundle branch further divides into anterior and posterior fascicles. As well as conduction block occurring in the AV node (i.e. heart block), a block can occur in conduction of the electrical impulse through one or more of these conduction pathways. The most commonly seen conduction defects seen are

in dogs:

- right bundle branch block (RBBB)
- left bundle branch block (LBBB)

and in cats:

- left anterior fascicular block (LAFB).

These result in abnormal depolarisation patterns as there will be a delay in depolarisation of the part of the ventricles supplied by the affected conduction tissue. This is also referred to as aberrant ventricular conduction or ventricular aberrancy.

Right bundle branch block

Right bundle branch block (RBBB) occurs due to failure/delay of impulse conduction through the RBB. Depolarisation of the left ventricle occurs normally, but depolarisation of the right ventricular mass occurs through the myocardial cell tissue resulting in a very prolonged complex.

ECG characteristics

The QRS duration is prolonged (>0.07 seconds). The QRS complex has deep and usually slurred S waves in leads I, II, III and aVF and is positive in aVR and aVL. The MEA is to the right (Fig. 10.1a and b). Note that RBBB needs to be differentiated from a right ventricular enlargement pattern.

(a)

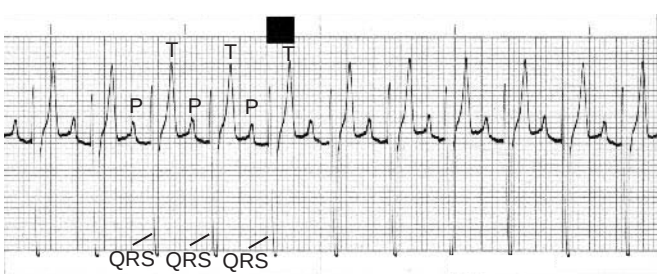

Figure 10.1 (a) ECG (lead II) from a 10-year-old mixed breed dog with a normal sinus rhythm at 140/min, but conducted with aberrancy through the ventricles due to right bundle branch block. This was an incidental finding. Note the abnormal morphology of the QRS complexes, with deep (negative) Q waves and prolonged QRS duration. There is a P for every QRS, indicating the sinus origin of the depolarisation (25 mm/sec and 10 mm/mV).

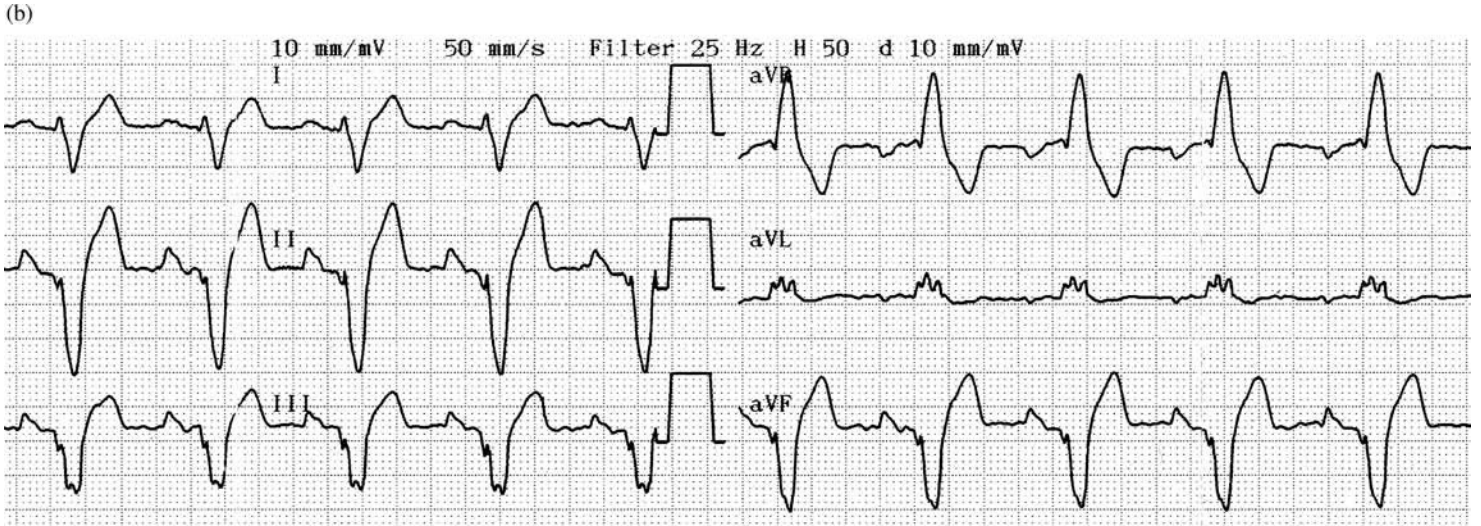

Figure 10.1 (b) ECG from a mixed breed dog with RBBB showing all six limb leads. The complexes are very prolonged and negative in leads 2, 3 and aVF and the most positive lead is aVR (50 mm/sec and 10 mm/mV).

Figure 10.1 (c) ECG (lead II) from dog with atrial fibrillation (note the irregular R–R intervals and the fibrillation waves) and right bundle branch block (deep S waves and prolonged QRS durations) (25 mm/sec and 10 mm/mV).

An animal with atrial fibrillation can concurrently have bundle branch block (Fig. 10.1c); this is often a more challenging ECG interpretation!

Clinical findings

The heart sounds and rhythm will sound normal with associated palpable pulses. In some dogs, with very careful auscultation a split second heart sound (S2) may be heard, due to delayed closure of the pulmonic valve.

Left bundle branch block

Left bundle branch block (LBBB) occurs due to failure of conduction through the LBB. Depolarisation of the right ventricle occurs

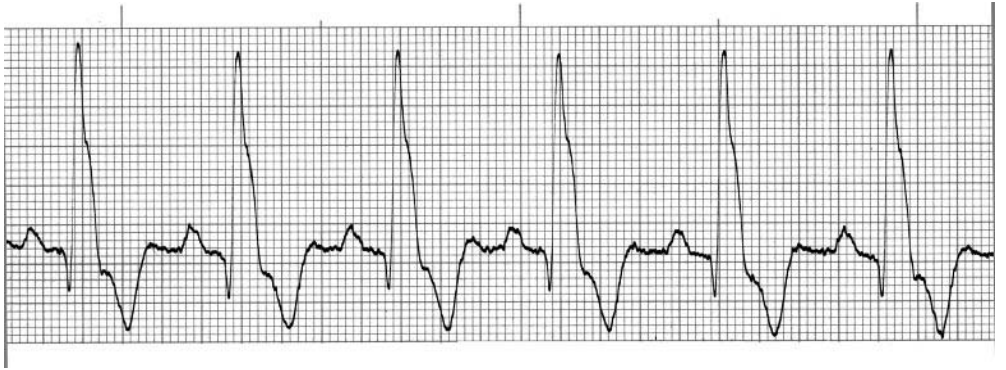

Figure 10.2 (a) ECG from a dog with a normal sinus rhythm conducted through the ventricles with aberrancy due to left bundle branch block. Note the abnormal morphology of the QRS complexes, yet related to the P waves, i.e. there is a P for every QRS, indicating the sinus origin of the depolarisations (50 mm/s and 10 mm/mV).

normally and depolarisation of the left ventricle is delayed and occurs through the myocardial cell tissue resulting in a very prolonged complex.

ECG characteristics

The QRS duration is very prolonged (>0.07 seconds). There are positive complexes in leads I, II, III and aVF and negative in aVR and

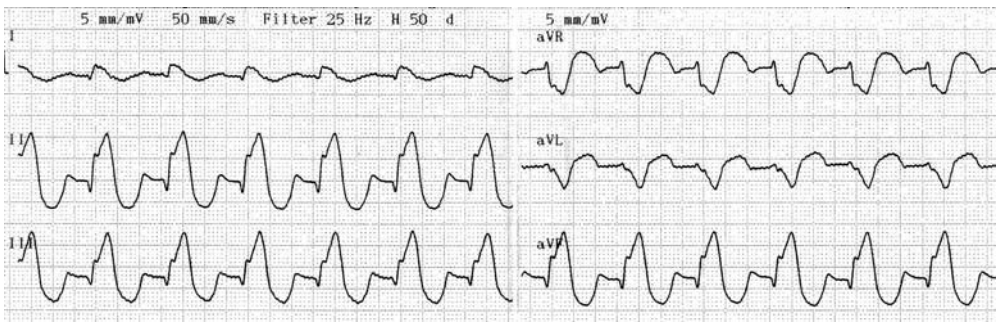

Figure 10.2 (b) ECG from an 8-year-old Boxer dog with LBBB showing all six limb leads. Note the very prolonged QRS complexes and leads 1, 2, 3 and aVF are positive whereas aVR and aVL are negative (50 mm/sec and 5 mm/mV).

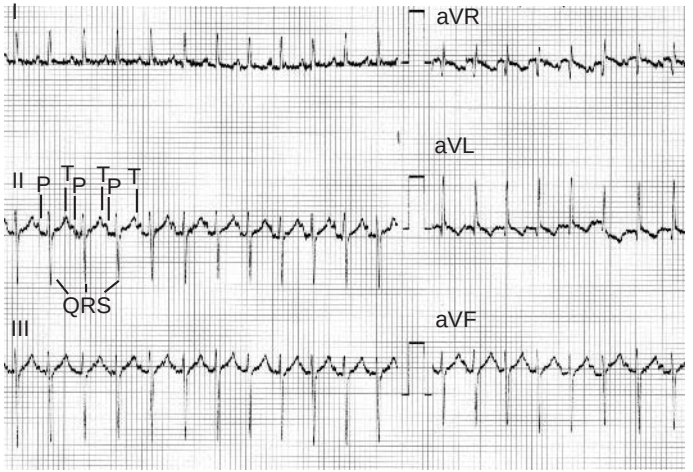

Figure 10.3 (a) ECG from a cat with taurine-responsive dilated cardiomyopathy. There is a normal sinus rhythm but aberrant ventricular conduction due to anterior fascicular block (see text) (25 mm/sec and 10 mm/mV).

aVL (Fig. 10.2). LBBB needs to be differentiated from a left ventricular enlargement pattern.

Clinical findings

The heart sounds and rhythm will sound normal with associated palpable pulses.

Left anterior fascicular block

Left anterior fascicular block (LAFB) occurs due to failure of conduction through the anterior fascicle of the LBB. It is not an uncommon finding in cats but is rare in the dog.

ECG characteristics

The QRS complex is normal in duration but there are tall R waves in leads I and aVL, deep S waves (>R wave) in leads II, III and aVF. The MEA is markedly to the left; approx. −60° in the cat (Fig. 10.3a).

A cat with atrial fibrillation can also concurrently have fascicular block (Fig. 10.3b).

Clinical findings

The heart sounds and rhythm will sound normal with associated palpable pulses.

Figure 10.3 (b) ECG from a cat with atrial fibrillation and anterior fascicular block.

Figure 10.4 (a) ECG showing intermittent right bundle branch block. Note that there is a sinus rhythm throughout, with a P wave preceding every QRS complex, however there is a change in morphology with some (arrowed) (25 mm/sec and 10 mm/mV).

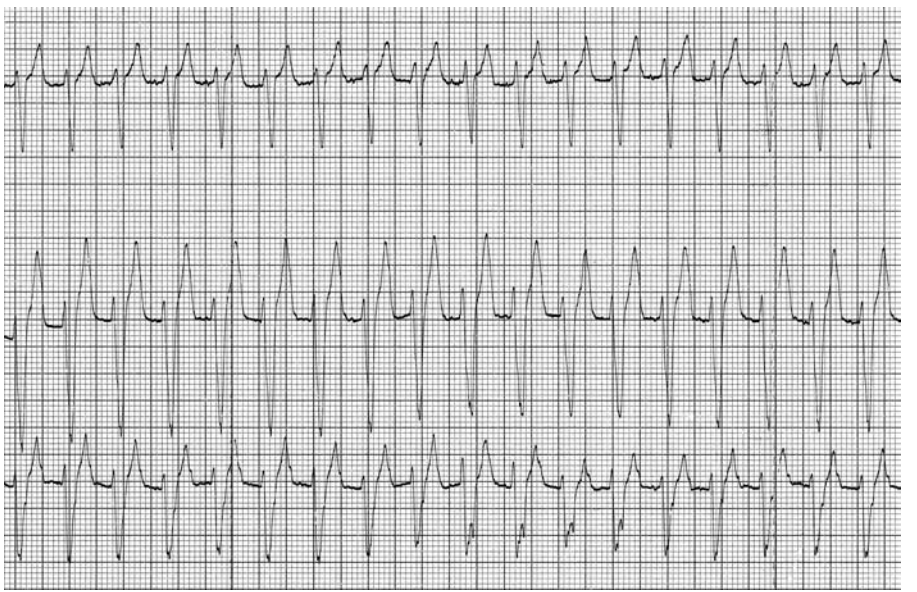

Figure 10.4 (b) ECG from 4-year-old Golden Retriever with a broad complex tachycardia, which could be either a ventricular tachycardia or an SVT with aberrancy. Following cardioversion an underlying right bundle branch block was evident, confirming this to be an SVT (50 mm/sec and 10 mm/mV).

More terminology . . . . . VPC morphology

In Chapters 4 and 5 the morphology of VPCs was described as having a −ve or +ve QRS complex. In ECG-speak however, the morphology of the QRS complex is described as being of LBBB or RBBB morphology. It is not until ventricular aberrancy has been explained, that this terminology can be used. So for example in Figs 4.1, 4.8b and 5.5a the VPCs would be described as having RBBB morphology and in Figs 4.2c, 5.3, 5.4b and 5.7c they would be described as having LBBB morphology.

In Boxer dogs with arrhythmogenic right ventricular cardiomyopathy, in which the VPCs arise from the right ventricular outflow tract, they are described as VPCs with LBBB morphology.

Intermittent ventricular aberrancy

This is sometimes seen when a supraventricular premature depolarisation reaches the bundle branches before one or other has fully repolarised (usually the right bundle branch), i.e. is still partially depolarised, which results in a functional block. Because the QRS complex is premature and bizarre in shape it mimics a VPC.

If a supraventricular tachycardia (SVT) is associated with aberrant ventricular conduction, this will mimic a ventricular tachycardia (VT). Thus the term a **broad complex tachycardia** is sometimes used to describe this ECG finding.

ECG characteristics

The QRS complex is bizarre and prolonged, often a right bundle branch block morphology and is premature. It can be very difficult to distinguish from a true VPC (Fig. 10.4a). If there is a preceding P wave visible (and not hidden by the previous T wave) then this might help to confirm it was a supraventricular complex.

An SVT with aberrancy will mimic a VT (Fig. 10.4b).

Clinical findings

It sounds like premature beat, and will have a pulse deficit. An SVT with aberrancy will simply produce a tachycardic sounding heart with weak pulses.