Gating Setup when large artifacts are present in the ECG waveform

A common artifact in the ECG waveform is caused by vibrations of ECG leads due to activation of the pulsed gradients. When the MR scanner acquires imaging data, pulsed gradients are activated which generate acoustic noise, movement of the gradient insert and corresponding movement of the ECG leads. Vibration or movement of the ECG leads in the presence of the strong static magnetic field can create large artifacts on the ECG waveform.

Many factors contribute to the size and extent of vibration artifacts on the ECG waveform. High field strength, long lead length, leads that are not taped and close coupling of the animal to the gradient insert all make vibration artifacts more extensive. However, in many cases it is not necessary to minimize the effects of vibration. It is usually possible to create accurate and reliable triggers even with the presence of large artifacts on the ECG waveform.

Follow these steps to generate accurate gating when large artifacts are present:

1. When the scanner is not acquiring data, check that each R-wave is detected and that no false gates are generated. i.e make certain a red dot (ECG gate) is present for each R-wave and that there are no extra red dots in the Cardio Sweep display. If this is not the case, adjust the R-detect parameters according to Chapter 3 of the Operation Manual.

2. Set the blanking time to 90% of the R-R interval. Note the R-R interval is displayed below the heart rate. Right clicking the ECG display will open the R-DETECT SETUP window.

3. Run a gated scan with the total slice acquisition time at least 20 msec less than the animal's R-R interval. It maybe useful to initially run a single slice scan to observe the effect of gradient vibrations on the ECG waveform. As you increase the number of slices, you will observe an increase in the width of the artifact following the trigger generated by the R-wave. Note that 5 to 10 msec are required for the vibrations to damp after the pulsed gradients are turned off. If the total slice acquisition time is too long, a false trigger will be generated at the end of the blanking time.

As an example, consider the case of a cine field echo sequence run on an animal with a heart rate of 600 beats per minute (R-R interval of 100msec). Setting the blanking time to 90 msec will accommodate an arrhythmia rate of up to 10%. If the single slice acquisition time is 10 msec, then 8 slices can be acquired each at a different phase in the cardiac cycle. Note that if 9 slices are attempted, false gates will occur as the vibrations ring down after the end of the blanking time and the images will not be accurately gated.