Bioengineering 278: Magnetic Resonance Imaging Laboratory
Winter 2010
Lab 10

For this lab you will be using stock GE pulse sequences to examine the heart. Place a human in the scanner, using the 8 channel torso array coil. Use breath holding for all data, and the automatically reconstructed dicom images.

1. **iDrive.** Use the iDrive real time imaging protocol to find long axis and short axis planes to use as localizers. Write a one word summary of your impression of how cool iDrive is. (2 points)
2. **Measure the torsion of the heart using myocardial tagging**. Prescribe a 3 slice short axis scan, with one at the apex, one at the base, and one in between. Specify approximately 10 phases across the cardiac cycle.
    a. Estimate the torsion between diastole and systole. Relative to diastole, how many degrees of twist is present between apex and base at end systole? A simple way to measure the rotation in each slice is to identify two points on opposite sides of the ventricle, and measure the rotation of the line between those two points. Twist is the difference in rotation between apex and base. Define a right handed helix as a positive twist. (6 points)
3. **Ejection Fraction**. Ejection fraction is defined as the fraction of the left ventricular blood volume at end diastole that is ejected by end systole. Collect at least 5 short axis cine images with 10 or more cardiac phases. For each slice, measure the area of the blood pool at the largest and smallest cardiac phases, and use these to estimate the ventricular volume at these phases.
    a. Estimate the EF of the subject. (6 points)
4. **Flow through aorta.** Collect a cine phase contrast image at the root of the aorta. Use the FastCard cine phase contrast pulse sequence, the 'phase difference' option, and under 'User CVs' disable the magnitude masking option.
    a. Integrate the flow through the aorta across space and time in order to estimate the total blood flow through one cardiac cycle. Compare with the measurement of total blood expelled from the heart during one cardiac cycle from part 3a. (6 points)