This file provides information about the dynamic image sets in the folders QIBA_v14_Tofts_GE and QIBA_v14_Tofts_Siemens.

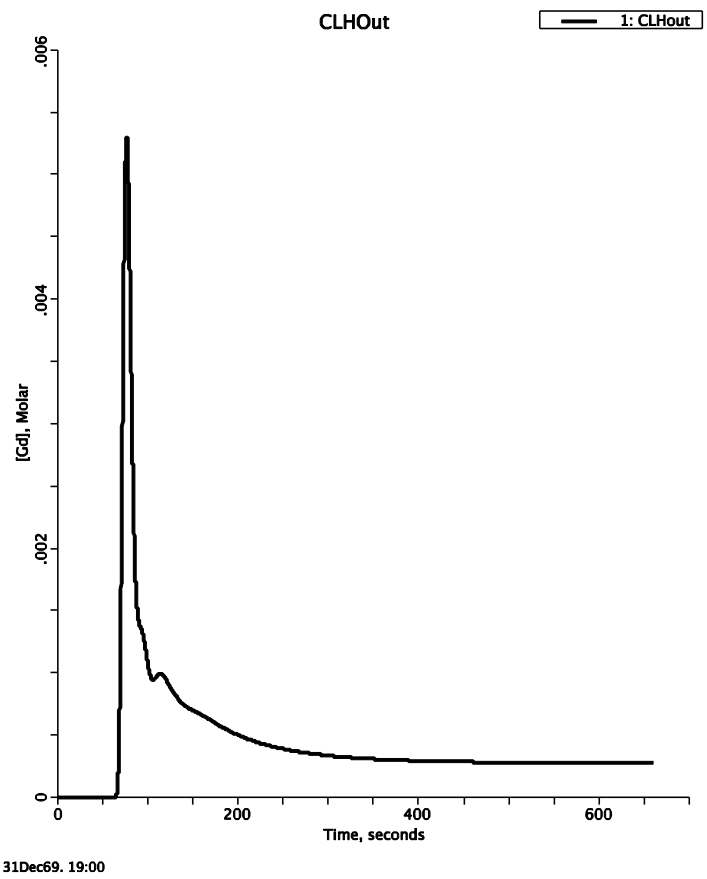
This data set simulates images obtained when a patient has a lower cardiac output. These patients would be expected to have lower and broader input functions.

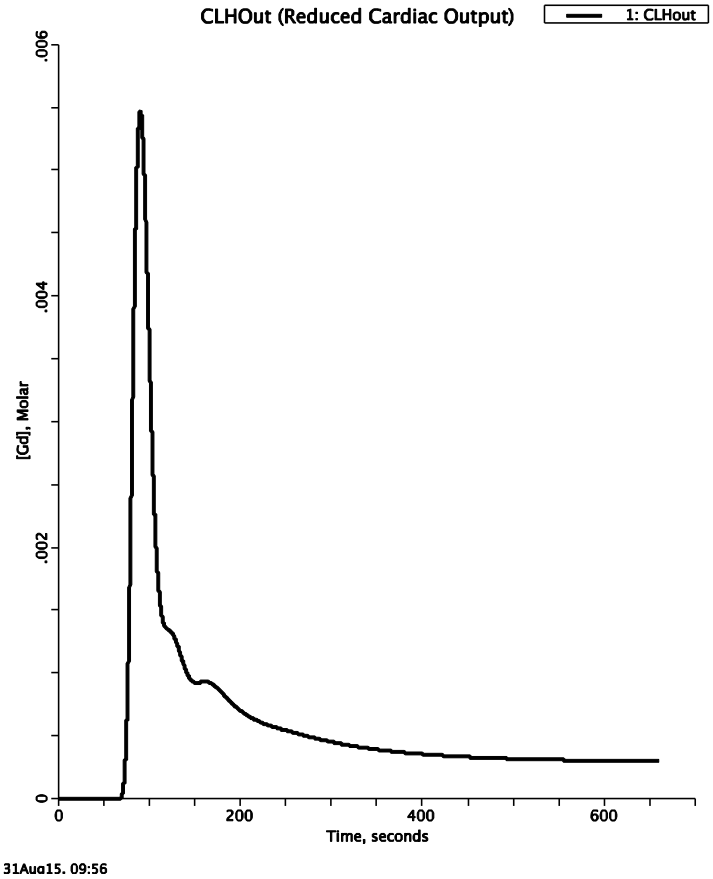
The image data for the GE and Siemens sets are identical. The only difference is that the GE series contains DICOM headers that a GE machine would generate, while the Siemens series contains DICOM headers from a simulated Siemens machine*.

Two sets of images are provided for each series. DICOM part 10 format images are in the DICOM directory. XML files are in the XML directory. The XML images allow the values for the DICOM tags to be altered using a text editor, and new DICOM images can then be generated using dcm4che's tool called "xml2dcm," available at http://www.dcm4che.org/confluence/display/d2/dcm4che2+DICOM+Toolkit.

The reduced cardiac output data set has two primary series. The first ("QIBA_Dyn_20150713") has imaging parameters identical to version 5, except that the modeled cardiac output is 50% lower. The second series ("QIBA_Dyn_fa30_Vary_Int_Off_20150713") has imaging parameters identical to version 9, except that the modeled cardiac output is 50% lower.

These graphs show the effect of a 50% reduction in cardiac output on the concentration of gadolinium contrast agent over time. Note the broader, slightly lower, input function.





I. QIBA_Dyn_20150713
Flip angle = 25 degrees
Repetition time = 5 msecs
Time interval between the DCE images = 0.5 seconds
Assumed T1 (in tissue) = 1000 msecs

Assumed equilibrium magnetization (in tissue) = 50000
Assumed T1 (in blood vessel) = 1440 msecs
Assumed equilibrium magnetization (in blood vessel) = 50000

A 5.5 minute study is simulated, with injection of contrast agent occurring at 0 seconds.

The input function for this series was derived from the JSim model ToftsKermode_2p_Reduced_Cardiac_Output_330sec_20150713.proj (available on the QIBA page of our website). A link the JSim website is also provided. This function representing a blood concentration time curve was converted to a plasma concentration time curve assuming a blood hematocrit of 45%. The relaxivity of the gadolinium contrast agent at 1.5 T was assumed to be 0.0045 $mmol^{-1}$ $msec^{-1}$ (Stanisz GJ, Henkelman RM. Gd-DTPA relaxivity depends on macromolecular content. Magn Reson Med. 2000 Nov;44(5):665-7. PubMed PMID: 11064398).

II. QIBA_Dyn_fa30_Vary_Int_Off_20150713
Flip angle = 30 degrees
Repetition Time = 5 msecs
Assumed T1 (in tissue) = 1000 msecs
Assumed T1 (in blood vessel) = 1440 msecs

This series varies the sampling interval, temporal jitter (timing offset), S0, and simulated noise level (sigma). Noise was applied using the formula $A = \sqrt{(R + r1)^2 + (r2)^2}$ where *A* is output "actual" signal intensity with noise, *R* is the input "noiseless" signal intensity, and *r*1 and *r*2 are gaussian noise with mean 0 and SD sigma.

For each series, the value of S0 in tissue equals the value in the blood vessel.

The sampling interval, timing offset, S0, and sigma value combinations are as follows:

6s,0s,500,5	6,3,500,5	10,0,500,5	10,5,500,5
6s,0s,500,50	6,3,500,50	10,0,500,50	10,5,500,50
6s,0s,1000,10	6,3,1000,10	10,0,1000,10	10,5,1000,10
6s,0s,5000,75	6,3,5000,75	10,0,5000,75	10,5,5000,75
6s,0s,5000,100	6,3,5000,100	10,0,5000,100	10,5,5000,100
6s,0s,5000,250	6,3,5000,250	10,0,5000,250	10,5,5000,250
6s,0s,10000,100	6,3,10000,100	10,0,10000,100	10,5,10000,100

A 5 minute study is simulated, with injection of contrast agent occurring at 60 seconds. Thus, the total duration of imaging is 360 seconds.

The input function for this series was derived from the JSim model ToftsKermode_2p_Reduced_Cardiac_Output_fa30_660sec_20150713.proj (available on the QIBA page of our website). A link to the JSim website is also provided. This function representing a blood concentration time curve was converted to a plasma concentration time curve assuming a blood hematocrit of 45%. The relaxivity of the gadolinium contrast agent at 1.5 T was assumed to be 0.0045 $mmol^{-1}$ $msec^{-1}$ (Stanisz GJ, Henkelman RM. Gd-DTPA relaxivity depends on macromolecular content. Magn Reson Med. 2000 Nov;44(5):665-7. PubMed PMID: 11064398).

The naming convention for the study folders is
"<sampling interval>_jit_<timing offset>_S0_<s0 value>_sigma_<sigma value>".
Thus, 6s_jit_0s_S0_500_sigma_5 has a sampling interval of 6 seconds, an offset of 0 seconds, an S0 value of 500, and a sigma value of 5.

For all sets in (I) and (II), GE timing information is included in the DICOM headers at fields 0008,0032 (Acquisition Time) and 0018,1060 (Trigger Time). The imaging start time for Siemens machines is given in the DICOM headers at fields 0008,0030 (Study Time) and 0008,0031 (Series Time), and acquisition time for each image is given in the DICOM headers at fields 0008,0032 (Acquisition Time) and 0008,0033 (Image Time).

Also for all series, the data in the test image is organized as follows:

The test data is generated using several combinations of Ktrans and Ve, using the modified Tofts Kermode 2-parameter model. The Ktrans takes values {0.01, 0.02, 0.05, 0.1, 0.2, 0.35}. The Ve takes values {0.01, 0.05, 0.1, 0.2, 0.5}.

The test data contains 10*10 pixels patches of each Ktrans and Ve combination. While generating the test data, the Ve values {0.01, 0.05, 0.1, 0.2,0.5} vary along the x axis. Ktrans values {0.01, 0.02, 0.05, 0.1, 0.2, 0.35} vary along the y axis.

The Vascular region of interest is the bottom 50*10 pixels strip of the image. The peak of the Vascular region is the top-left 25*10 pixels strip of the image. This strip also contains time point labels given in seconds. The Zero patch (Ktrans=0.0, Ve=0.5) is the top-right 25*10 pixels strip of the image.

The following is a detailed list giving the specific Ktrans,Ve combination used to generate each 10*10 pixel patch. The x,y location specifies the upper-left corner of each 10*10 pixel patch containing a specific Ktrans,Ve combination.

x	y	Ktrans	Ve
0	10	0.01	0.01
0	20	0.02	0.01
0	30	0.05	0.01
0	40	0.1	0.01
0	50	0.2	0.01
0	60	0.35	0.01
10	10	0.01	0.05
10	20	0.02	0.05
10	30	0.05	0.05
10	40	0.1	0.05
10	50	0.2	0.05
10	60	0.35	0.05
20	10	0.01	0.1
20	20	0.02	0.1
20	30	0.05	0.1
20	40	0.1	0.1
20	50	0.2	0.1
20	60	0.35	0.1
30	10	0.01	0.2
30	20	0.02	0.2
30	30	0.05	0.2
30	40	0.1	0.2
30	50	0.2	0.2
30	60	0.35	0.2
40	10	0.01	0.5
40	20	0.02	0.5
40	30	0.05	0.5
40	40	0.1	0.5
40	50	0.2	0.5
40	60	0.35	0.5

* Slight modifications to the DICOM headers may be required in order to make them compatible with a particular software package.