3T MR Research Program

Center for MR Research

University of Illinois at Chicago

TECH 2000 3T MRI RESEARCH FACILITY

SUMMER 2015 ISSUE

3T Research News

By Mike Flannery

The 3T MR Research Program is excited to report that we have successfully integrated the eye monitoring system with the Invivo SensaVue fMRI stimulus system. We recently acquired 2 key components for the new system:

- Ultra covert IR source and
- Custom 36"x18" single piece hot mirror.

The new equipment now allows for robust eye monitoring with the rear projection SensaVue system while minimizing any visual distractions.

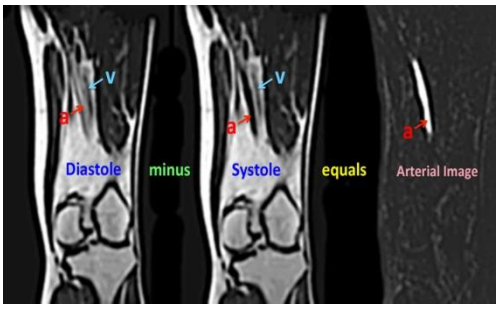
We would like to encourage everyone to utilize the SensaVue system for all new projects now that the eye monitoring feature is available.

As a friendly reminder to everyone, we are no longer maintaining or supporting the MRIx front projection system. Investigators may continue to use the front projection system as long as it is functioning; however, we cannot guarantee normal operation.

GE MR750 Advanced Application: Inhance 3D DeltaFlow

Inhance 3D Velocity is a pulse sequence designed to acquire non-contrast enhanced MRA images of the peripheral arterial vasculature. This technique is based on 3D, fast spin echo which acquires two echoes: one during diastole and the other in systole. During the systolic phase, the arterial flow is fast resulting in a dark signal within the vessel. Arterial flow during the diastolic phase is significantly slower resulting in a bright signal. The venous flow and background tissue signals of the same scanned region do not change in intensity during the cardiac cycle.

The systolic image slab is then subtracted from the diastolic image slab. The resulting image reveals superior visualization of arteries with sufficient suppression of the background tissues.



This imaging technique was implemented with this edition's Research Spotlight.

Research spotlight

Determining the Objective Standards for Diagnosing and Stratifying Raynaud's and Related Disorders: Developing the First Gold Standard

Dr. Nadera Sweiss, MD

Dr.Sweiss is an Associate professor of Medicine, Director of the Rheumatology Clinical Research and Cold Hand Clinic, and Director of the Sarcoidosis Translational Advanced Research Program (STAR).

The main focus of current research project at the 3T MR Research Program is to determine the vascular flow rates in the hands of subjects with a history of Raynaud's phenomenon.

The following study report was provided by Dr. Kezhou Wang, PhD from Vassol. The GE Inhance 3D Delta-Flow sequence was used to create the 3D model of arteries in this study. Figure 1 and 2 shows the MIPs and 3d models of the right hand and left hand respectively. The models were used to specify the flow measurement locations. The PCMR flow images were acquired at the prescribed locations. All the data were acquired with a GE 3T Discovery MR 750 research scanner.

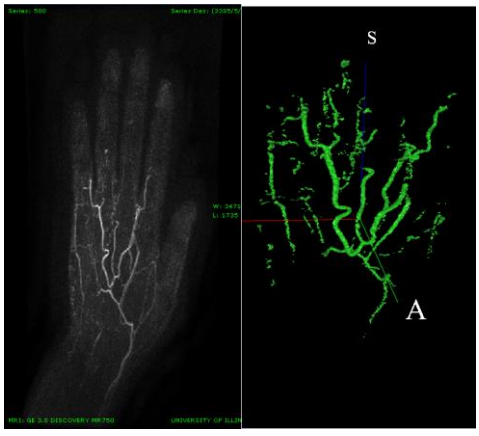


Figure 1. Coronal MIP of Delta-Flow sequence and 3D model of the right hand.

The digital artery vessel names and their relative positions are shown Figure 3. Only the abbreviation names are listed in the schematic map. Once the vessel flow measurement location is specified on a 3D model, a NOVA PCMR flow sequence images will be acquired at that location and orientation. The image data will be processed on the NOVA system, and the flow rate and velocity information can be obtained for each measured vessel.

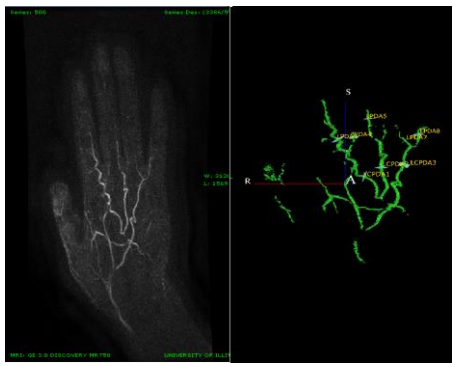


Figure 2. Coronal MIP of TOF images and the 3D model of the left hand

Results

Right hand: The flow measurement results are shown in Table 1.

Left hand: The flow measurement results are shown in Table 2.

Discussion:

This is an interesting case. The right hand artery tree is significantly different from all other digital artery topology we have seen so far. A very deep artery (RDCPDA1) supplies blood flow for the index finger as shown in Figure 4. The flow in the first common palmar digital artery is reversed as shown in Figure 5, and it was supplied by a deeper artery (RDCPDA12) as shown in Figure 6. The other two common palmar digital arteries were supplied by the reverse flow in RCPDA1 as shown by Figure 5. The most of the flow goes to RCPDA3, as the flow in RCPDA2 was too low to be measured. Besides, the flow rates are in RCPDA1 and RCPDA3p arteries with opposite sign, as listed in Table 1. This is quite significant. The number is exactly the same. Both distal and proximal flows in RCPDA3 were measured, and the locations and flow directions are shown in Figure 7 and Figure 8.

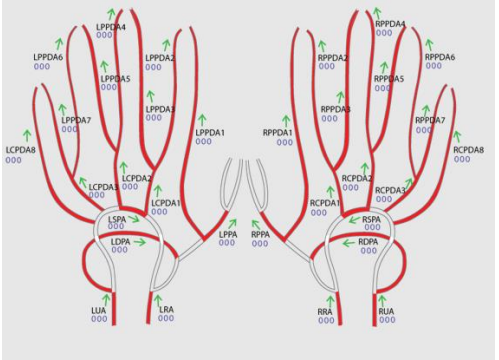


Figure 3. Finger Digital Artery Schematic Map and Vessel Names. CPDA - Common Palmar Digital Artery, PPDA - Proper Palmar Digital Artery, DPA - Deep Palmar Arch, SPA - Superficial Palmar Arch

Table 1. Flow Summary for Right Hand Digit Arteries

Vessel Name	Flow Rate (mL/min)	Peak Velocity (cm/s)	Mean Velocity (cm/s)
RPDA1	-	-	-
RPDA2	-	-	-
RPDA3	-	-	-
RPDA4	-	-	-
RPDA5	-	-	-
RPDA6	0.9	1.4	0.9
RPDA7	5.3	4.9	2.7
RPDA8	-	-	-
RCPDA1	-6.5	5.5	2.5
RDCPDA1	7.3	8.8	6.1
RDCPDA12	6.2	5.6	2.9
RCPDA2	-	-	-
RCPDA3	4.3	4.3	2.3
RCPDA3p	6.5	5.0	1.7

Note: - means data not available for measurement.

Table2. Flow Summary for Left Hand Digit Arteries

Vessel Name	Flow Rate (mL/min)	Peak Velocity (cm/s)	Mean Velocity (cm/s)
LPDA1	-	-	-
LPDA2	-	-	-
LPDA3	5.4	7.8	4.1
LPDA4	-	-	-
LPDA5	2.3	2.7	2.0
LPDA6	1.0	3.0	2.0
LPDA7	0.3	0.6	0.3
LPDA8	1.0	1.3	0.9
LCPDA1	7.2	3.4	1.9
LCPDA2	2.5	3.1	1.4
LCPDA3	1.8	1.6	0.5

Note: - means data not available for measurement.

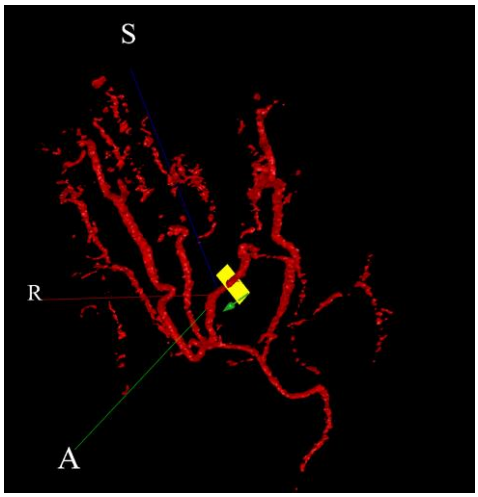


Figure 5. Right Hand: The blood flow in RCPDA1 is reversed with a flow rate of 6.5mL/min. The blood is supplied by a deep artery as shown in Figure 6.

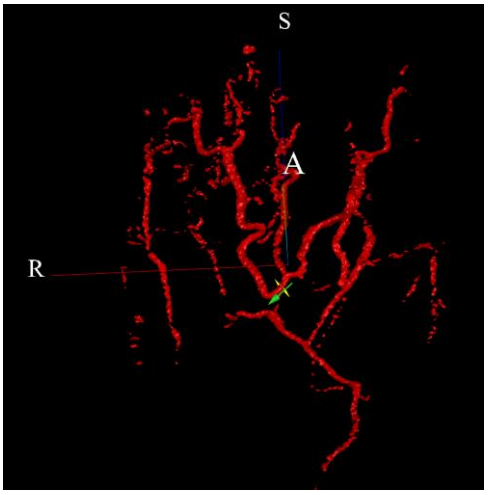


Figure 7. Right Hand: Flow measurement of RCPDA3 at a proximal location.

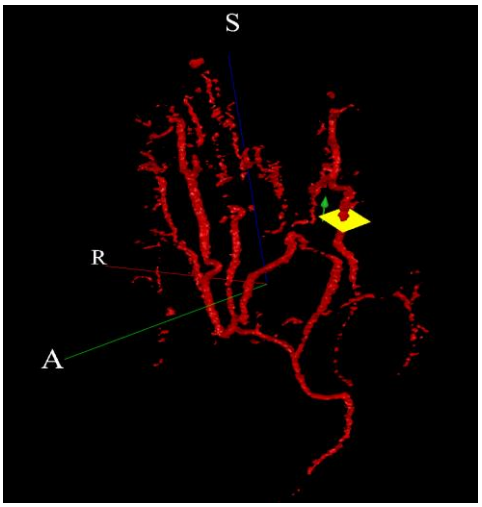


Figure 4. Right Hand: The blood flow of the arteries in the index finger is supplied by a deeper artery with a flow rate of 7.3mL/min. Other data refers to Table 1 with vessel name RDCPDA1.

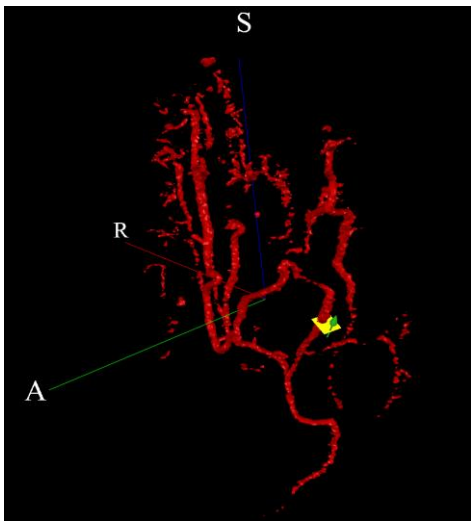


Figure 6. Right Hand: The deeper artery (RDCPDA12) provides blood flow with a rate of 6.2mL/min for RCPDA1, RCPDA2 and RCPDA3.

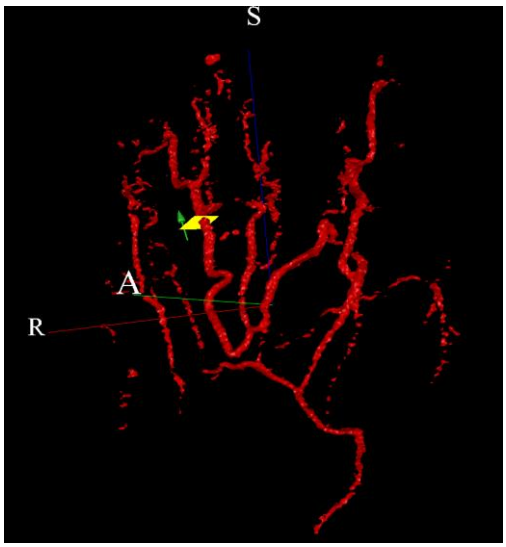


Figure 8. Right Hand: Flow measurement of RCPDA3 at a distal location.