The 4D Advanced Data Analysis Lab at Northwestern University provides world-class excellence in the field of advanced Cardiovascular Magnetic Resonance Image analysis services. Our Lab recognizes the activities of the physician and scientist investigators who are often behind the scenes evaluating new devices, new therapies, or improved processes, all under the careful control and guise of quality assurance and compliance programs.

Objectives and Vision

Our objectives
To provide cutting edge cardiovascular imaging analysis with dedicated staff and resources for enhanced data management.

Provide timely analysis of your cardiovascular study using dedicated well equipped up-to-date workstations.
The analysis is performed by highly trained analysts, who work with high accuracy. To ensure quality we regularly perform internal qualitative assurance.

Commitment to collaborative clinical research with defined, measurable patient-centered outcomes.

Implementation and identification of metrics/milestones with a focus on relevant and translational research that will lead to enhanced outcomes and new discoveries.

Our Goals

Aim to efficiently integrate new post-processing demands into the clinical workflow to improve efficiency, reduce operating cost and shorten the time needed from imaging to diagnosis.

Want to make available novel diagnostic tools for the comprehensive evaluation of cardiovascular disease beyond the capabilities of other centers, to improve patient care and attract new business (referrals, clinical studies, and industry sponsored research).

The analysis we provide reflects the highest quality standards and reliable, effective and consistently delivered with a focus on the needs of the project.

Our Vision

In the future, the 4D lab will provide improved ability to quickly translate novel quantitative markers of disease progression into the clinical workflow. Novel imaging modalities such as PET-MR will further increase the data complexity (metabolic information) and demand multi-modular integration. The Cardiovascular 4D lab will provide improved efficiency in imaging and radiological diagnosis and can flexibly be expanded to include additional body regions and/or imaging modalities.

The Team

Maria Carr, RT.R
Assistant Research Professor

4DLab – advanced image data analysis

Background

Services

1. Cardiac MRI Data Analysis
   a) Cardiac 2D Flow Analysis includes:
      • Calculation of flow velocity parameters (e.g. mean and max velocity, mean, cumulative, prograde, retrograde flow)
      • For large and small vessels.
      • Semi-automatic detection of regions of interest over time
      • Color-coded display of velocity values.
      • Calculation of flow and velocity parameters (e.g. peak velocity, average velocity, flow, integral flow)
      • Graphical and tabular display of the results (e.g. flow-time curves).
   b) Cardiac Function Analysis includes:
      • Automatic, semi-automatic, or manual segmentation of the left and right ventricle
      • Volumetric Analysis and wall thickness analysis.
      • Output of parametric results, volume-time curves and bull's-eye plots.
      • DICOM structured Reporting.

2. Advanced 4D Flow Data Analysis
   • 4D Flow data preprocessing (noise correction, eddy current correction, anti-aliasing, calculation of the phase contrast angiogram)
   • Advanced segmentation of the phase contrast angiogram
   • Visualization of 4 dimensional blood flow
   • Calculation of basic flow parameters (net flow, peak velocity, regurgitation)
   • Calculation of advanced flow parameters

2. T1 and T2 Mapping, Tissue Phase Mapping
   • T1 mapping:
     ➔ detection of fibrosis and scar
     ➔ assessment of myocardial viability
   • T2 mapping
     ➔ detection of myocardial infection and edema
     • Tissue Phase Mapping (TPM):
       ➔ mapping cardiac tissue motion
       ➔ detection of dyssynchrony

3. Providing core lab functionality and support
   • Generation and management of database
   • Generate the Standard Operations and Procedures (SOP) and provide the Manual of Operations (MOP) for the successful completion of the study.
   • Organize data transfer and storage.
   • Help with establishing MRI protocols

Figure 1. Cardiac function and mass analysis

Figure 2. Advanced 4D Flow Analysis

Figure 3. Tissue Phase Mapping

Past, Ongoing and Future Studies

1. Vitamin D study, Wayne State University
   • 2nd observer study, R² = 0.82
   • Status: finished

2. COMBINE study, NIH
   • Multi-center study (6 imaging centers)
   • Core lab for cardiac MRI
   • Organization of:
     ➔ SOP, MOP, data transfer
     • Cardiac Data Analysis
   • Status: ongoing, about to recruit

3. Potential Future Studies:
   • Multicenter 4D flow study (Columbia University)
   • AIB Study with Jeff Goldberger (Industrial Sponsor?)

How to proceed?

• Plan your study together with us early on already during grant writing
• Feel free to contact us any time

Regular Updates and Contact

Contact us through the webpage, via email or call:

Susanne Schnell, PhD
Director 4D Lab
Assistant Research Professor
Tel: 312-695-3099

Maria Carr, RT.R (CT) (MRI)
Project Manager 4D Lab
Tel: 312-926-5292

Department of Radiology
Northwestern University
757 North Michigan, Suite 1600
Chicago, IL 60611
4dlab@northwestern.edu

Webpage:
http://4dlab.northwestern.edu/

Twitter:
https://twitter.com/NU4DLab

Facebook
https://www.facebook.com/4DLabNorthwestern

LinkedIn:
https://www.linkedin.com/company/4d-lab