



## Case Study

### Cincinnati Children's Propels the Value of MRI in Monitoring Pediatric Heart Disease to New Heights.

There's a good reason Cincinnati Children's Hospital Medical Center has ranked in the top three hospitals in National Institutes of Health (NIH) research funding for pediatrics in recent years. Researchers such as Drs. William Gottliebson and Kan Hor seem to have a sixth sense about the efficacy of promising research tools.

At the Society for Cardiovascular Magnetic Resonance (SCMR) meeting in 2003, Dr. Gottliebson, associate professor of pediatrics, attended a talk on a new software solution that reads and analyzes DICOM images of MR tagging to analyze the motion of the heart.

Dr. Gottliebson's background in biomedical engineering, coupled with an interest in regional myocardial function, drove him to find out more about the software solution, called HARP®. The name is an abbreviation for the software's HARmonic Phase techniques that measure and visualize the regional motion of the heart. "Originally, I was interested in using regional strain measurement for a small study I was conducting regarding adolescent and young adult patients with a previously 'repaired' congenital heart disease called Tetralogy of Fallot." Dr. Gottliebson says. "Patients with this condition need lifelong monitoring of the function of the heart's right ventricle." Dr. Gottliebson hypothesized that regional strain assessment of that chamber would prove valuable for these patients. Gottliebson's request for study funding included funds for a couple of research copies of HARP.\* When Dr. Kan Hor, M.D., assistant professor of pediatrics, joined the faculty, he quickly became an expert in using the software.

While awaiting enrollment of enough Tetralogy patients, Drs. Hor and Gottliebson decided to perform strain measurement in a series of studies on a very different but burgeoning patient population — young males with Duchenne Muscular Dystrophy, a fatal disease usually

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**William Gottliebson, M.D., M.S.,  
Pediatric Cardiologist, Associate Professor  
of Pediatrics and Biomedical Engineering**

diagnosed at around age five. The results have been dramatic.

As Dr. Hor says, "Strain analysis has provided a unique opportunity to assess ventricular function in a population for whom traditional methods of ventricular function analysis have not been sensitive enough. We think strain analysis may provide us with a better tool for looking at the progression of disease, compared to traditional echocardiography or MRI analysis such as ejection fraction. It is proving to provide a great opportunity to help this underserved population of patients."

According to Dr. Gottliebson, Cincinnati Children's Hospital Medical Center runs one of if not the biggest clinic of Duchenne Muscular Dystrophy patients in the country and possibly in the world, so he expects his colleagues who manage those patients will soon start asking for myocardial strain values.

Dr. Hor believes that going forward is really a matter of further defining the natural history of the disease, and, hopefully, converting strain analysis from being a

\*Research copies of HARP are readily available by [clicking here](#).

research tool to a clinical tool. "First, we will continue to look at the progression of the disease," Dr. Hor says, "and, second, we will look at the effect of medication or medical treatment on cardiac function or improvement of strain value, as opposed to ejection fraction and other 'traditional' parameters. People look at ventricular function in many different ways. I think strain analysis is a potential tool to help us detect cardiac dysfunction and regional dysfunction earlier, without having to wait until we have decreased ejection fraction."

The researchers originally hypothesized that strain would be abnormal in Duchenne patients, but, until they were able to measure strain using HARP, lack of sensitivity of other measurement techniques did not demonstrate abnormalities. Their next goal will be to get doctors to understand the meaning of abnormal strain. They hope to next use strain measurement in a clinical trial, as the principal marker being tracked. "We'll attempt to prove that the strain is a meaningful lone indicator of the state of the ventricle, and that absence of change in strain over time with therapy is also important," Dr. Gottliebson says. "We will measure strain in this male pediatric cohort, that is getting one clinical regimen as opposed to another. Once the data clearly shows differences in a relatively small study, we plan to move on and repeat it on a larger scale at multiple institutions."

Dr. Hor hopes for expanded research that leads to clinical applications for the use of strain measurement. "We hope that we can translate our research into clinical utility, and see if strain changes with age to see progression of the disease," he says. "Our current patient population might use strain analysis in addition to traditional measurements of cardiac function during treatment trials."

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**Kan Hor, M.D.,  
Assistant Professor of Pediatrics**

In Summer 2009, Drs. Hor and Gottliebson decided to assess strain in two additional congenital heart disease patient groups within the scope of their practice: patients with functional single ventricle status post Fontan operation, as well as patients who have transposition of the great vessels status post atrial switch procedure many years ago. Both of these patient groups are at risk of long term ventricular dysfunction, and thus require frequent surveillance. "We expect to find that, just as in the DMD patients, strain will indeed prove a more sensitive indicator of subclinical ventricular dysfunction in these and other patient groups."

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*HARP®, a registered trademark of Johns Hopkins University, is the first FDA-cleared software designed for the analysis of tagged magnetic resonance images. It is marketed and sold exclusively by Diagnosoft®, Inc. For more product information, click [here](#).*

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