

Ultrasound Supplement

undergoing human clinical trials. During the last three years of the study, the team plans to test the devices on 40 patients to 60 patients each year. The team hopes the devices' extremely small sizes will also make them effective ultrasound tools for use in children and infants.

Sahn has worked on developing new ultrasound methods for children and newborns for almost 30 years. During that time, with NIH funding, he helped create one of the first high-frequency miniaturized ultrasound probes for imaging babies.

Sahn hopes the ultrasound technology developed with this grant will be used for diagnosis and treatment of other conditions throughout the body for which a small probe for imaging and treatment might replace major surgery.

For more information, call 503-494-8311 or visit www.ohsu.edu.

— Oregon Health & Science University



Photos courtesy of Oregon Health & Science University

Producing an ultrasound image through a catheter already in the heart, rather than a patient's throat, can greatly improve outcomes while eliminating the need for anesthesia, as well as reducing procedure duration, radiation exposure and cost.

Tissue Doppler Imaging

Emerging ultrasound technology helps kids with heart transplants

Preliminary results of an ongoing study presented at this year's annual meeting of the International Society for Heart and Lung Transplantation show that tissue Doppler imaging (TDI), when used in conjunction with traditional echocardiography, can detect signs of terminal heart failure up to 12 months before young transplant patients' hearts actually fail. For the 50 percent of all pediatric heart transplant patients who will need another heart transplant within 12 years due to failure or rejection, this early detection is critical because it gives the child's family enough time to re-list and receive a new heart.

Derek A. Fyfe, MD, PhD, along with fellow researchers at Sibley Heart Center at Children's Healthcare of Atlanta, is conducting a study of pediatric heart transplant patients using TDI, a technology that measures heart function without the invasive elements of biopsy.

Fyfe says tissue Doppler has been popular in Europe for about 10 years but only in the last two years in the United States. Basically, TDI converts the speed of heart contraction and relaxation into a numerical graph in order to plot a chronometer of the

cardiac cycle. This chart gives researchers an index of the heart's functional performance.

Fyfe says his team encountered two problems in the course of their research: diagnosing rejection in children with heart transplantation and finding measurable parameters of both right and left ventricular function (relevant to well-being and prognosis).

"We received a grant from Children's Healthcare of Atlanta to prospectively study children who have had heart transplants," says Fyfe. He says the research team organized the study participants into two groups: new transplants and those who previously had a transplant returning for routine evaluations. During their initial hospitalization after their transplant, the children were studied every day for five days. Subsequently, they were studied weekly or monthly, depending how far out they were from their transplant.

Fyfe says the team used tissue Doppler data and correlated it with other measurements. "For example, when children come in for a biopsy, we actually put a catheter into the right ventricle and take a piece of tissue out and send it to the pathology laboratory,"

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Tissue Doppler Imaging

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he says. "At the time we do that study, we also do the tissue Doppler and compare the velocities we're getting to the clinical state of rejection of the patient."

In terms of results, Fyfe says the research team has just published preliminary findings on their first series of patients in the June issue of the *Journal of Heart and Lung Transplantation*. They found that, in general, all transplant children have diminished right ventricular systolic and diastolic function that never becomes completely normal.

"Subsequent to that study, at [the Scientific Sessions of] the American Society of Echocardiography in May, we presented another study that showed that immediately after transplantation, the right ventricle is severely impaired in the majority of patients and that it gradually improves over the next three months," Fyfe says.

Right ventricular deterioration is one of the most common — and critical — problems for transplanted hearts, typically occurring during the first week after transplant, when invasive biopsies cannot be safely performed. By providing a window on the heart in those first days, TDI can give physicians an opportunity to react to any abnormalities before they become life threatening.

This fall, Fyfe will present findings from another part of the study at the American Academy of Pediatrics' national conference, which show that the later phases of the transplant's life can be identified. "What that means is that all transplants have a finite life span," Fyfe explains. They have this peculiar phenomenon of accelerated coronary artery diseases — as if the hearts themselves are 70 years old after only about 12 years in some cases." He says that about half of the transplants are no longer good after transplantation



Photo courtesy of Children's Healthcare of Atlanta

Victor White, a 7-year-old heart transplant patient from Columbus, Ga., is tested with tissue Doppler imaging (TDI) at Children's Healthcare of Atlanta. Physicians at Sibley Heart Center at Children's are testing the non-invasive imaging technology against traditional biopsy procedures with the hope that one day, TDI may replace the more costly and sometimes-painful biopsies transplant patients now undergo.

due to infection, rejection or coronary arteriopathy.

"What we've been able to show is that by using tissue Doppler, we can identify the patients that have reached essentially end stage. This is something that we couldn't do before because we didn't have a numerical quantitation of right and left ventricular function that really relates to this," Fyfe says. "Using normal standard measures of heart function by echo may look OK, but when you look at tissue Doppler of the right ventricle, in particular, you see very abnormal velocities. What we've done is study eight patients within eight months of their death or their re-transplantation and found that group is statistically different from all of the other transplant patients."

Fyfe notes the "wonderful cooperation that we have had with the families of these children. They're all incredibly excited to cooperate in a research project that can help other children after they've been helped so much themselves. That's been really rewarding."

— T.S.