

P E D I A T R I C C A R D I O L O G Y T O D A Y

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PEDIATRIC CARDIOLOGY TODAY

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PEDIATRIC CARDIOLOGY TODAY CELEBRATES ITS FIRST ANNIVERSARY

Pediatric Cardiology Today (PCT) celebrates its first anniversary at PICS VIII & ENTICHS II. The newsletter has come a longer way than most would imagine. It was originally conceived on the side-lines of the youth soccer fields in Potomac, Maryland in the late 1980s. With little guys running around the soccer fields, two dads had several casual conversations about "what they did." One was a pediatric cardiologist, and the other was a sales and marketing publishing executive specializing in high-tech companies. It took a while to get into what pediatric cardiology was all about, how it was a small specialty serving a relatively unique patient population, but needing lots of technologies to do so. Details about technical journals and newsletters also arose from those talks: targeting technical audiences, monthly publications with short times to print, timely articles written by experts, news items of unique interest to the target audience, etc. As soccer season ended, the two dads, John Moore and Tony Carlson, concluded that pediatric cardiology would benefit from a technical publication of some sort.

Fifteen years later, Tony, now running his own businesses, reminded John about the publication which they had discussed years earlier. The idea still seemed like a good one, and they decided to "go for it." Tony found industry sponsors, and a publisher and editor, Richard Koulbanis. Tony and Richard had been in publishing together off and on for over 20 years, and Richard had held such positions as VP/Strategic Planning for Elsevier US Holdings, VP & Group Publisher, VP/Research Publishing, and was now managing his own consulting business. Tony and Richard discussed just what type of publication would be best suited for this small close-knit medical community. They decided on a newsletter format. They then moved on to the tasks of creating a subscriber base, designing the publication and website, developing business, editorial and marketing plans, and deciding how the publication would be distributed. A subscriber list of over 2,000 pediatric cardiologists in the U.S. and Canada was created from scratch. This



Figure 1. Pediatric Cardiology Today's premier issue (September 2003) in the old format and style.

whole process took another nine months before the launch in September of 2003. Since then, Pediatric Cardiology Today's distribution has expanded to include other interested physicians and specialists (e.g. cardiac surgeons), pediatric cardiology nurses, government and private researchers.

During that same nine month time period, while PCT was being made ready for its inaugural issue, John found colleagues interested in serving on the Editorial Board: Ziyad Hijazi, Jim Perry, Gerald Marx, Anthony Chang, and Gil Wernovsky.

The first issue (Figure 1) hit the street at the PICS & ENTICHS meeting in Orlando, September 2003. Twelve issues later, a new design, and another PICS & ENTICHS meeting (Chicago, IL), Pediatric Cardiology Today is still going strong.

The first year has been eventful. The newsletter expanded from 8 - 12 pages to a steady 12 - 16 pages and sometimes ex-

panding to twenty. Feature articles have spanned the range of the specialty. Memorable articles, to mention only a few, have included:

- "Genetics of Heart Disease" by Jeffrey Towbin, MD (August 2004)
- "Telemedicine Applications in Pediatric Cardiology" by Craig Sable, MD (July 2004)
- "Transcatheter Patch Occlusion of Heart Defects" by E. B. Sideris, MD (April 2004)
- "Nesiritide, A New Drug for Children with Heart Failure" by Jennifer Zuccaro, MD (January 2004)
- "Emerging Strategies in the Treatment of HLHS: Combined Transcatheter & Surgical Techniques" by Sharon Hill, ACNP, Mark Galantowicz, MD and John Cheatham, MD (November 2003)

In addition, the newsletter has carried summaries of important pediatric cardiology meetings, important events like the Chuck Mullins Catheterization Laboratories dedication, passing of prominent colleagues and mentors, clinical trial information, new products and services, government and regulatory issues, and other newsworthy features.

New publication launch ideas often take on a life of their own. While attending medical meetings, Pediatric Cardiology Today met and talked with many physicians from Europe and other parts of the world who asked if PCT was published outside the U.S. and Canada. In response to those requests, PCT has decided to launch Congenital Cardiology Today (CCT), a newsletter to serve Europe, Latin/South America, Asia and the Middle East. PCT has recently created a website for subscription development of Congenital Cardiology Today, and is now in the midst of acquiring the

names of physicians in pediatric and congenital cardiology at hospitals, institutions, and private practices worldwide. Congenital Cardiology Today will premier in early 2005.

Pediatric Cardiology Today is proud to serve the dedicated physicians, nurses, and researchers in pediatric cardiology. These medical professionals, with their special expertise for diagnosis and treatment, have helped, and continue to help, countless children overcome congenital heart disease.

PCT and CCT invite readers to contribute articles about their research, clinical work, or practice, which may be of interest to their colleagues, whether it is in the USA, Canada, Europe, South and Latin America, the Middle East, and Asia. See the contact information below.

For comments to this article, send email to: Anniversary@PediatricCardiologyToday.com

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MEDICAL CONFERENCES

11th Paediatric Pacing Workshop
September 30 - October 1, Bristol, UK
www.bcs.com

9th Annual Meeting of the European Council for Cardiovascular Research (ECCR)
October 1-3; Nice, France
www.eccr.org

NPCNA (The Northeast Pediatric Cardiology Nurses Association) 20th Anniversary Conference
October 2; Sturbridge, MA
www.npcna.org

32nd Annual Meeting & Scientific Sessions of the North American Society for Cardiac Imaging (NASCI)
October 2-4; Amelia Island, FL
www.nasci.org

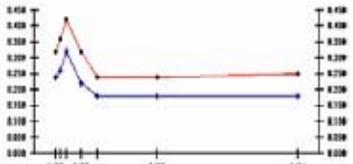
The American Academy of Pediatrics 2004 National Conference & Exhibition
October 9-13; San Francisco, CA
<https://s12.a2zinc.net/clients/aap/aap2004/>

Children's Hospital San Diego Congenital Cardiovascular Surgery Symposium
October 15-16; 2004 San Diego, CA
www.chsd.org/body.cfm?id=1753

Canadian Pediatric Cardiology Association CCS Meeting
October 26-30; Edmonton, Canada
www.cardioped-canada.org/congress/congress.asp

British Society of Interventional Radiology Annual Meeting
November 2-4; North Yorkshire, UK
www.bsir.org

American Heart Association Scientific Sessions 2004
November 7-10; New Orleans, LA
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PREVIEWS OF DAILY DEBATES: PICS VIII & ENTICHS II

PICS VIII & ENTICHS II will be known for the 30 live case demonstrations coming in from catheterization laboratories and operating rooms in 11 cardiac centers in Europe and North America. In addition, the meeting will feature daily debates, covering controversial topics which are foremost in the minds of many cardiologists and surgeons.

In the mini-articles and paragraphs which follow, Pediatric Cardiology Today previews these debates by highlighting the major discussion points of the debaters.

Monday - Sep. 20th; 5:20-6:00 PM

Debate of the Day: "Management of Native Coarctation of the Aorta: Balloon Angioplasty/Stent Implantation vs. Surgical Repair"

Balloon Angioplasty/Stent Implantation:

José Suárez de Lezo, MD
Córdoba, Spain

Surgical Repair:

Tom Karl, MD
University of California at San Francisco

Percutaneous Treatment of Coarctation of the Aorta

By José Suárez de Lezo, MD

Following twenty-one years of experience with percutaneous treatment for severe aortic coarctation at our center, we still believe that the mechanical relief of these conditions provides a useful and complementary alternative for life long management of patients. The age at first treatment is an important issue and, not infrequently, patients need more than one mechanical treatment (surgery or percutaneous procedure) throughout their lives. During my presentation I will try to argue where percutaneous treatment may be a useful alternative:

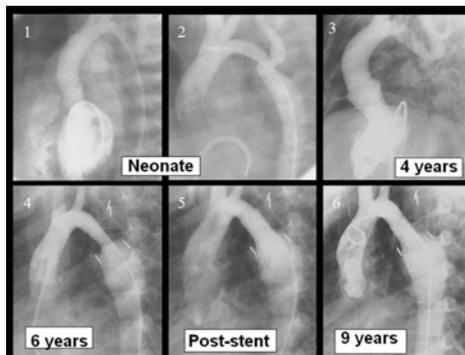


Figure 1. Serial angiograms obtained from a patient at different ages and conditions. 1 shows a left ventriculogram in LAO-projection performed at the neonatal period; the left ventricle is dilated because of heart failure and through a muscular VSD the right ventricle is opacified; a critical coarctation can also be observed. 2 shows the aortogram post balloon angioplasty which provided a significant clinical improvement. The infant did well but re-coarctation was diagnosed without heart failure. At the age of 4 years, was re-catheterized: 3 shows a new ventriculogram in the same view; at this time, the muscular VSD became spontaneously closed, the size of the ventricle is reduced and recoarctation is evidenced. The patient was sent to surgery where a subclavian flap anastomosis was performed. However, a new restenosis was detected 2 years later (4). A stent was implanted (5). 6 shows a new aortogram three years later.

1. First, I'll focus on severely ill neonates and infants with intractable heart failure, which is associated with a high mortality rate. Balloon angioplasty at an early age may effectively alleviate heart failure (1). However, controversy still persists and there is no information on the need for further treatments. I will discuss the long-term evolution of a series of 54 neonates and infants with severe coarctation of the aorta treated early with balloon angioplasty and monitored in a 19-
2. Then, I will discuss our experience with balloon angioplasty in children and adults (3). Balloon angioplasty in children and adults may provide a prolonged benefit, mainly in patients with a discrete type of coarctation. However, about 11% of patients may develop significant late residual gradient or aneurysm.
3. Next, I will focus on a discussion of a group of infants and children, under the age of 6, who were treated with stent implantation for non-dilatable stenoses, as a non-definitive procedure. Stent palliation provides complete initial relief in hypoplastic coarctations or life-threatening conditions (4). However, further stent expansion is required to ensure adequate stent diameter in the growing aortic wall. In addition, late intrastent proliferation may occur in small stent diameters (18%) and aneurysm formation in hypoplastic coarctations (18%). Both late complications can be managed percutaneously.
4. Finally, I will discuss our 11-year experience in the stent repair of severe coarctation of the aorta in adults, adolescents and children over the age of six (4,5). In the majority of this group of patients (n=73) stent treatment was attempted as a definitive procedure for coarctation. There were 20 children (6-12 years), 15

year follow-up survey (2). After balloon angioplasty, most infants sustained significant clinical improvement. However, nine patients died in the hospital (17%). As a result, we monitored the course of the 45 survivors during a mean period of 10±6 years (range: 1-19 years). Figure 1 illustrates how the combination of percutaneous and surgical treatments may be effectively combined in a given patient. The actuarial survival probability was 83% at 19 years, with 43% of patients remaining surgery free and 23% re-intervention free.

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adolescents (13-17 years) and 38 adults (>17 years). Twenty-one patients had undergone a previous intervention for coarctation (14 balloon angioplasty, 6 surgery and 1 combined). Significant relief was always achieved. However, one patient (1.3%) died suddenly 3 hours after a successful procedure. After a mean follow-up time of 5 ± 3 years (range 1-11) all 72 patients remain symptom free. Angiographic follow-ups performed 2 ± 0.5 years after treatment in 24 patients have shown persistent benefit in all patients, with no cases of restenosis or aneurysm formation (Figure 2). Similar serial imaging follow-up findings were obtained for all patients with nuclear magnetic resonance (MR). The last MR-image study was performed at a mean follow-up time of 4 ± 3 years. There have been no cases of recurrence or aneurysm formation.

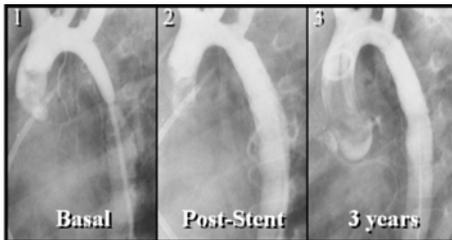


Figure 2. Serial aortograms obtained from a patient 8 years old with severe coarctation treated with stent repair.

In light of the above I will conclude that today, percutaneous intervention for aortic coarctation provides a useful and complementary alternative to surgery for the long-term management of patients. Both surgeons and cardiologists should work together to find the best possible options for each patient in line with their age and clinical condition.

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Surgical Repair

Dr. Tom Karl, University of California, San Francisco, will debate in favor of surgical repair. He is expected to point out that modern surgery is much improved over techniques reported in the older literature, and to emphasize that coarctation is often associated with aortic arch hypoplasia, which can only be effectively dealt with by surgical techniques. He may also assert that due to the very high angioplasty restenosis rates, infants should only be considered for surgical treatment. He will probably also recommend that modern results be judged by routine follow up MRI/MRA and exercise testing, not by less definitive imaging and Doppler gradients. He will propose that surgical results will be superior to stent/angioplasty when routine definitive assessments are performed.

Tuesday - Sep. 21st; 5:00-5:40 PM

Debate of the Day: "TEE Versus ICE to Guide Device Closure of Atrial Communications"

TEE:

Charles S. Kleinman, MD
Children's Hospital of New York

ICE:

Qi-Ling Cao, MD
University of Chicago Children's Hospital

TEE

Dr. Charles Kleinman, Children's Hospital of New York, will argue in favor of TEE guidance of closure of atrial communications. He is expected to point out that TEE is the "gold standard" because it has been used to guide closure of septal communications since the beginning, in the 1980's. Thousands of procedures and the test of time have proven its efficacy and safety in this role. In addition, widespread availability of the equipment and expertise required to perform TEE, make it the preferred option.

Comparison of ICE vs. TEE for ASD Device Closure

By Qi-ling Cao, MD

Few studies have compared the use of intracardiac echocardiography (ICE) versus transesophageal echocardiography (TEE) during the closure of atrial septal defects (ASD).^(1,2) These imaging modalities can be compared on the basis of imaging, risks and limitations, the cost involved, and the relative administrative or non-medical benefits.

Imaging quality of ICE and TEE has been reported.⁽²⁾ ICE transducers use imaging frequencies of 5 to 10MHz (depending on the machine), compared to 4 to 8 MHz for TEE transducers. TEE imaging of the interatrial septum involves passing through a number of reflective surfaces (esophagus, atrial wall), while ICE imaging does not. TEE probe placement is

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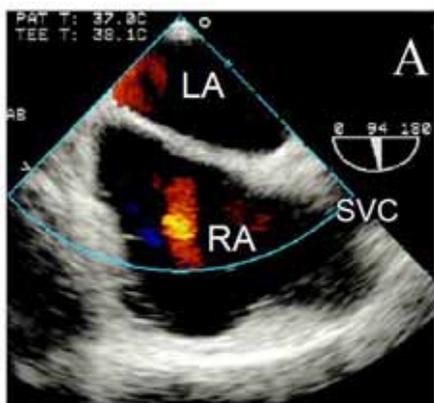


Figure A. TEE study: Interatrial septum intact, color Doppler shows no atrial shunt.

limited to the upper GI tract with the ultrasound sector origin confined along this relatively linear path. However, within these constraints, TEE is able to generate various images due to probe rotation, probe advancement/withdrawal, and bi- or multi-plane imaging. ICE probe placement is not limited linearly as is the TEE probe. However, it is limited by the lack of bi-plane or multi-plane imaging. Given these relative constraints, both methods have been shown to produce adequate imaging for ASD occluder placement. However, ICE imaging has been shown to be superior for the inferior portions of the interatrial septum.(2)

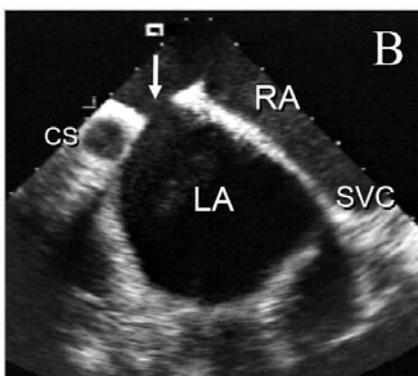


Figure B. ICE study: shows a 13 mm defect in the inferior-posterior of interatrial septum.

The risks of both ICE and TEE are low. Although risks of the former are expected to be similar to cardiac catheterization, arrhythmias have been the only reported complications.(3) In the University of Chicago series of over 300 cases, no complications have occurred using ICE, however, patient size was limited to over 8.5 kg. With newer ICE probes, this weight limitation will decrease. The risks of TEE have included the risk of sedation (or general anesthesia in children), trauma and airway obstruction. The latter has been reported in children, though the incidence is low, with no other significant complications reported.(4)

The cost of the ICE probe has been cited as prohibitive. Investigators at the University of Chicago have shown that the cost of ICE is not significantly greater than TEE.(5) It is felt that the additional cost of the ICE probe is balanced by the cost of general anesthesia (personnel and equipment) needed with TEE. It is felt that the cost of ICE can actually be made less than the cost of TEE by substituting a technician for a physician during ICE imaging.

In addition to the cost benefits, there are non-financial benefits of the ICE assisted procedure. These include easier procedure scheduling using ICE since fewer personnel need be involved (no anesthesiologists required). In addition, there may be emotional benefits of ICE assisted ASD closure since general anesthesia with its associated fear and discomfort can be avoided, using local anesthesia instead. In addition, patients may benefit from watching as the procedure is performed. The latter has not yet been addressed in a formal statistical analysis of patient preference.

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Wednesday - Sep. 22nd; 5:15-6:00 PM

Debate of the Day: "Is Cardiac Catheterization Needed Before Stage II and III Completion in Patients With Single Ventricle?"

Yes, it is needed:

Toshio Nakanishi, MD, PhD
Heart Institute of Japan
Tokyo Women's Medical Center
Tokyo, Japan

No, Echo/MR is Sufficient:

Mark A. Fogel, MD, FACC, FAAP
Children's Hospital of Philadelphia

Cardiac Catheterization is Necessary Before Stage II and III Procedures in Single Ventricle Physiology

By Toshio Nakanishi, MD, PhD

Mortality of Stage II and III procedures and morbidity after these procedures are still high. In order to minimize the mortality and morbidity, hemodynamic and anatomical abnormalities should be detected before these procedures; presence or absence of coarctation of the aorta, pulmonary artery distortion, high pulmonary resistance, and/or abnormal collateral vessels should be evaluated. Coarctation of the aorta can usually be visualized by echo and MRI; catheterization is not required unless coarctation of the aorta is to be treated with interventional catheterization. Cardiac catheterization is needed to measure pulmonary resistance. It is usually possible to perform Stage III, if the pulmonary resistance is less than 3 Wood unit.M2 before Stage II, although the pulmonary resistance may be more than 3 Wood unit.M2 after Stage II. Therefore, it is important to evaluate the pulmonary resistance before Stage II. Echo and MRI may fail to visualize pulmonary artery distortion. One side of the pulmonary artery may be occluded by the thrombus despite the fact that MRI suggests the presence of both sides of the pulmonary arteries. Echo sometimes fails to visualize

peripheral pulmonary arteries. Stage III procedure can be difficult, if not impossible, with only one side of the pulmonary artery. Furthermore, abnormal aorto-pulmonary collateral vessels may develop after Stage II procedure. Echo and MRI do not visualize these vessels. Coil embolization may be required to treat these vessels. Further, collateral vessels between the superior vena cava and left atrium may develop after Stage II procedure and echo and MRI do not visualize these vessels. These vessels may also be required to be treated before Stage III procedure. In conclusion, cardiac catheterization is required to evaluate abnormalities which can be treated by interventional catheterization and to reduce mortality and morbidity of Stage II and III procedures.



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Non-Invasive Evaluation Throughout "Routine" Staged Fontan Reconstruction: Evolution, Not Revolution

By Mark A Fogel, MD

Non-invasive evaluation of patients throughout "routine" staged Fontan reconstruction is an evolution, not a revolution; look no further than comparing the standard of care in the repair of ventricular septal defects or tetralogy of Fallot today with 15 years ago. Even a recent American Heart Association position paper states "Improved noninvasive diagnostic techniques have narrowed the indications for diagnostic catheterization."

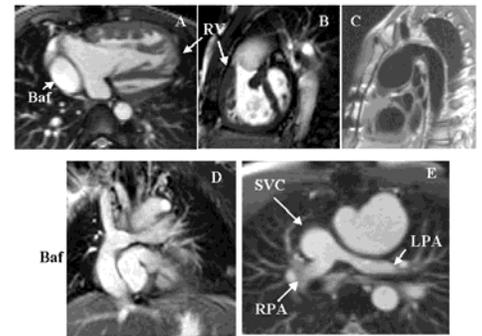


Figure 1. Patient with hypoplastic left heart syndrome after Fontan utilizing MRI. Steady state free precession MRI of the "4-chamber" (A) and short axis (B) views of the ventricle are demonstrated. Dark blood image of the reconstructed aorta is shown in (C). Steady state free precession MRI of the systemic venous pathway and pulmonary arteries are shown in (D) and (E) respectively. Baf=affle, LPA=left pulmonary artery, RPA=right pulmonary artery, RV=right ventricle, SVC=superior vena cava.

Why a test is (or should be) performed in the first place (i.e. cardiac catheterization) is to gain information that can be used in the care of the patient beyond what the healthcare provider already knows; that is to say, to increase the pre-test probability of the information being sought to a level with which confident clinical decisions can be made. With the advent of echocardiography and cardiac magnetic resonance imaging (CMR) to accurately assess cardiovascular anatomy, physiology and function combined with standard history, physical examination, chest x-ray and ECG, non-invasive estimation of the well being of the patient with the single ventricle can be obtained to make well informed medical decisions. CMR can obtain 3-dimensional anatomic imaging, viability, perfusion and functional parameters such as ejection fraction, cardiac index, regurgitant fraction, ventricular volumes and mass independent of geometric assumptions (Figures 1 and 2). Anomalies of end-diastolic pressure and pulmonary vascular resistance will manifest themselves in

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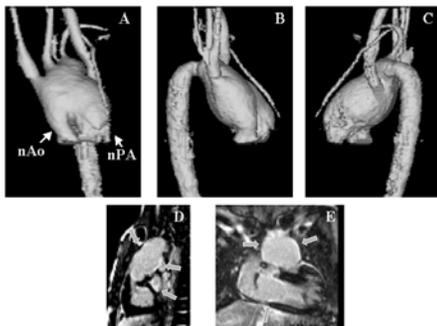


Figure 2. Patient with hypoplastic left heart syndrome after Fontan utilizing MRI. 3 views of a shaded surface display of the reconstructed aorta from an anterior (A), right lateral (B) and left posterior view (C). The native ascending aorta (nAo) to pulmonary artery (nPA) anastomosis as well as the sharp taper to the arch at its apex (arrow) can be seen. A viability study in the ventricular short axis (D) and long axis (E) views can be seen with arrows pointing to the areas of high signal intensity, indicating fibrous tissue.

other ways non-invasively which would lead the clinician to obtain invasive measurements. Cardiac catheterization in "routine" cases adds little clinically relevant information; its place should be in assessment of the patient whose non-invasive evaluations are either equivocal, conflicting, demonstrate deterioration or need for intervention. This position is born out by data published in two recent studies, which suggest that information obtained by cardiac catheterization in routine cases added little to clinical care over non-invasive assessment.

The clinician must weigh the benefits of the "additional" information (if there is any) from cardiac catheterization in "routine" cases with the risks associated with it. A recent study of pediatric cardiac catheterizations found short term complications in nearly 9% of procedures. Long term effects are also a consideration with an increased cancer risk in patients undergoing cardiac catheterization. Even

more disturbing for pediatrics is the finding that age of exposure to ionizing radiation is inversely correlated with the risk for future neoplastic disease.

It is time that single ventricle clinical protocols are updated to reflect 21st century reality. As Oliver Wendell Holmes said, "The worst reason to do something is to say it was done in the days of King Henry VIII."

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~PCT~



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PICS VIII & ENTICHS II LIVE SESSIONS
Day / Time / Location / Panelists

Monday, September 20, 2004

8:10-10:00 AM

London, New York, Milan, Columbus
Drs. Ballerini, Berger, Ing, Sandhu

11:00 AM-12:30 PM

London, New York, Milan, Columbus
Drs. De Giovanni, Burke, Ebeid, del Nido

2:00-3:20 PM

Columbus, Milan, London
Drs. Feldman, Fogel, Galal, Ebeid

Tuesday, September 21, 2004

8:00-9:30 AM

Chicago, Omaha, Seattle
Drs. Fleishman, Galal, Kumar, Tomita

11:00 AM-12:30 PM

Chicago, Omaha, Seattle
Drs. Landzberg, Masura, Ludomirsky, Walsh

2:00-3:30 PM

Chicago, Omaha, Seattle
Drs. Lederman, Nakanishi, Nykanen, Thanopoulos

Wednesday, September 22, 2004

8:00-9:20 AM

Chicago, Miami, Houston
Drs. O'Laughlin, Onorato, Pass, Wilson

11:00 AM-12:20 PM

Chicago, Miami, Houston
Drs. Piechaud, Radhakrishnan, Radtke, Ewert

2:00-3:30 PM

Chicago, Miami, Houston
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ECHOCARDIOGRAPHY AS A RESEARCH TOOL IN PEDIATRICS

By Carolyn T. Spencer, MD

Echocardiography is the modality most commonly used to evaluate cardiac anatomy and function. Since this non-invasive technique is portable, safe, and readily available it has been used to measure surrogate end points in clinical trials of heart failure, hypertension, and surgical and medical interventions for heart disease. Such studies have led to a tremendous amount of clinical experience, which makes the technique even more valuable in clinical research. The difficulties in using echocardiography as a research tool lie in acquiring accurate, reproducible and reliable data, especially in multi-center clinical trials. Accurate data collection requires meticulous attention in defining the question to be answered by echocardiography, standardization of the echocardiography protocol and image acquisition, and uniformity of measurements and interpretation. Additional considerations in pediatric echocardiography include appropriate indexing of measurements to age or body surface area (BSA), sedation in the uncooperative patient, and the potential effect of heart rate on various indices. Many diseases in the pediatric study population are rare, therefore increasing the difficulty in performing large scale studies which are adequately powered to demonstrate a significant change in the desired parameter.

Echocardiography as a surrogate end point

Clinical efficacy end points are the "gold standard" for clinical research

studies. End points such as mortality, symptoms, and quality-of-life often necessitate evaluation of a large number of subjects to achieve significant differences between study groups. Surrogate end points are variables that may substitute for and reflect a clinical efficacy endpoint. These include biochemical markers of heart failure (neurohormones), hemodynamic measurements, and echocardiographic variables such as left ventricular (LV) ejection fraction, dimensions, and mass. Advantages of surrogate endpoints are the ability to utilize reduced sample size, shorter duration studies and therefore, reduced cost of the clinical study. The main disadvantage of surrogate end points is the challenge of proving a direct relationship between the surrogate end point and the intended clinical end point. For example, in adult heart failure trials, ejection fraction (EF) measured by different techniques has been shown to correlate with survival in subjects treated with afterload reduction (1) or beta blockers (2). However, in the BEST trial, bucindolol was shown to improve EF, but not confer a survival advantage (3).

Echocardiography for evaluation of LV mass and systolic function

In any study, the data derived from assessment of LV size, mass, and systolic function using quantitative echocardiography is dependent on individual physiologic variability (loading conditions), technical variability, image quality, reader variability, and methods of quantitative assessment. The majority of studies to assess these variables have been performed in adult subjects.

Kuecherer et al (4) demonstrated that for a variety of quantitative echocardiographic measures, subject variability contributes more to some variables (EF) and technical variability contributes more to others (LV mass). Inter-technician variability was greater than intra-technician, and inter-reader variability was greater than intra-reader. These authors recommend that readers be trained by measuring a series of standardized recordings before quantifying clinical studies, those technicians and readers performing the baseline studies

"The difficulties in using echocardiography as a research tool lie in acquiring accurate, reproducible and reliable data, especially in multi-center clinical trials."

be used for serial studies, and multiple measurements should be made for some variables. Other studies have demonstrated that the method of quantification affects reproducibility. For example, 2-dimensional (2-D) derived LV mass may be more reproducible than M-mode derived LV mass in adults (5) and this is the current recommended method by the American Society of Echocardiography (6). Although the results of echocardiography are often reported in the pediatric literature, there are few clinical studies using echocardiographic measures as a surrogate end point. Many studies report retrospec-



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tive analysis or descriptions of echocardiograms obtained as part of clinical practice.

Analysis of reliability of multicenter echocardiography in children was examined by the Pediatric Pulmonary and Cardiac Complications of Vertically Transmitted HIV Infection (P2C2) Study Group (7). Protocol - directed echocardiography was performed at 10 clinical sites, with standardization procedures including staff training at the local and central facili-

“The use of non-invasively derived diastolic function indices should be very valuable for both clinical practice and research. However, little data exists indicating that these indices are valid surrogate end points for clinically meaningful events.”

ties, quality control feedback to the local sites, and a core echocardiography laboratory with consistent supervision by two cardiologists. Over 700 echocardiograms were analyzed at the local sites and core laboratory. This study demonstrated significant variability between central and local measurement results. For example, the mean difference in fractional shortening measured at the core lab and at the local site was small (0.97%). However, the standard deviation and 95% confidence interval of this measure was large, and a fractional shortening of 32% measured at the core lab could be between 22% to 40% when measured locally. In addition, there was poor reliability of measuring change over time in individual children. The rec-

ommendations of this study group included standardization of image acquisition, use of a central core laboratory to perform all measurements, having 1 trained technician at each site, multiple re-measurements for each study, and more than 1 reader for each study. It is also beneficial to use normative data from the same core laboratory.

Evaluation of LV mass in clinical studies has yielded inconsistent results. In adult patients, both M-mode and 2D methods of calculating LV mass have been shown to correlate with LV mass obtained at autopsy (8). The P2C2 investigators demonstrated that in pediatric patients the M-mode derived LV mass Z-scores correlated with autopsy heart weight Z-scores (9). For serial studies in individual adult patients, M-mode derived LV mass may be reliable but the 95% confidence intervals tend to be wide (10). In a study of healthy children ages 10 – 17 years, the Project Heartbeat! investigators concluded that M-mode derived LV mass has good reproducibility and inter-institutional agreement based on low mean differences of repeated measurements from selected individual echocardiograms (11). Data from serial echocardiograms on the same subject were not evaluated. In addition, confidence intervals were not reported, yet the published data suggests that such variance data may be clinically relevant. Therefore, M-mode derived LV mass may be useful in detecting change in population studies but not in individual patients. There is also data to suggest that 2-dimensional derived LV mass may be more reproducible than M-mode derived mass (5;12), however, large studies have not been performed.

Echocardiography for evaluation of diastolic function

The use of non-invasively derived diastolic function indices should be

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“Pediatric practitioners are often led to extrapolate from the adult cardiac literature or rely on small underpowered studies and anecdotal experience. This approach has implications for both clinical research studies and individual patient care.”

very valuable for both clinical practice and research. However, little data exists indicating that these indices are valid surrogate end points for clinically meaningful events. There is some evidence that certain echocardiographic derived measures of diastolic function may correlate with invasive indices in children (13), but there are no studies assessing the test-retest or inter-institutional reproducibility of echocardiographically determined diastolic function parameters in children. A few studies suggest acceptable inter- and intra-observer variability for tissue Doppler imaging in children (13;14). A study in adults proposes that some diastolic function measures such as isovolumic relaxation time and E-wave deceleration time have large inter-study variability, while others such as tissue Doppler of the lateral mitral annulus are more reproducible (15). As a whole, the 80% confidence intervals for diastolic function parameters are relatively large making it more difficult to interpret change in individual patients (15). In pediatrics there is the additional complicating issue of heart rate effects on many of these indices and scant normative data. In addition to the difficulty with use of these measures as surrogate end points, there have been no large or confirmatory studies in children

evaluating the reliability, reproducibility, or validity of echocardiographically determined diastolic function measures. While the use of these indices in children has promise, more work needs to be done to evaluate their true utility.

A potentially useful measure of global ventricular function is the myocardial performance (Tei) index (15). The myocardial performance index (MPI) is a geometry independent Doppler derived measure of ventricular function. In relatively small studies the MPI has been shown to have low intra- and inter-observer variability in normal children (16). Although there are no studies in children evaluating the inter-study or inter-institutional reproducibility, MPI may be a useful index in children with cardiomyopathy or congenital heart disease in evaluating left, right, or single ventricle function.

Summary

Echocardiography is widely used in clinical practice and research studies, yet there are few well-designed, large-scale clinical research studies in pediatric patients using echocardiography. Pediatric practitioners are often led to extrapolate from the adult cardiac literature or rely on small underpowered studies and anecdotal experience. This approach has implications for both clinical research studies and individual patient care. In

“Echocardiography is widely used in clinical practice and research studies, yet there are few well-designed, large-scale clinical research studies in pediatric patients using echocardiography.”

order to use non-invasively derived cardiac performance measures as meaningful surrogate end points in pediatric clinical trials, more work is needed to evaluate the reproducibility and reliability of these indices. Such studies will be critical for improving

“Additional considerations in pediatric echocardiography include appropriate indexing of measurements to age or body surface area (BSA), sedation in the uncooperative patient, and the potential effect of heart rate on various indices.”

our ability to conduct appropriately powered clinical trials. Additionally, for many echo parameters there is a paucity of pediatric normative data. There is also limited assessment of how best to normalize for the effects of body size or age on the size of cardiovascular structures. Many Doppler derived variables, especially measures of diastolic function, are influenced by heart rate and published normative data for children is insufficient.

Echocardiography has the potential to be a powerful and useful research tool in pediatric patients. In order to maximize the use of echocardiography in the research setting, more information needs to be collected regarding pediatric normative data and the utility of echo derived parameters as surrogate markers in children. In pediatric clinical trials, the use of echocardiography requires appropriately powered studies with thorough and rigorous attention to protocol



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development, site and sonographer training, standardized image acquisition, quality control, and consistent interpretation. For multi-centered studies, a core echocardiography laboratory should be used for central blinding and interpretation to standardize measurements and reduce variability. Clearly, standardized cardiac assessment is important in pediatric clinical research and every effort should be made to get the most reliable and accurate data from these studies. These efforts will not only improve the quality of pediatric clinical research, but have a positive impact directly on patient care.

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Prevalence of Pediatric Metabolic Syndrome Increases as Children Become More Obese

NEW HAVEN, CT -- Pediatric Metabolic Syndrome, which is a group of risk factors in one person including obesity, insulin resistance, hypertension and other metabolic abnormalities, is present in nearly half of all severely obese children and adolescents and increases with worsening obesity, researchers at Yale report.

Published in the New England Journal of Medicine, the study examined the relationship between the degree of obesity and metabolic syndrome in 439 obese, 31 overweight and 20 lean children and adolescents between the ages of four and twenty. Researchers gave participants a standard glucose-tolerance test and measured blood pressure, plasma lipid, C-reactive protein and adiponectin levels. The research team further evaluated future cardiovascular risk in these participants.

Levels of triglycerides, high-density lipoprotein cholesterol and blood pressure were adjusted for age and sex. The study included participants from different racial backgrounds, including 41% white, 31% black and 28% Hispanic.

"We found that the metabolic syndrome is highly prevalent among obese children and adolescents, reaching nearly 50% in severely obese youth," said first author Ram Weiss, MD, clinical fellow in pediatrics at Yale School of Medicine. "We also found that worsening body mass index and insulin resistance, independently, increase the risk for the metabolic syndrome in obese youth. The main issue is that every amount of weight gain increases risk for type 2 diabetes and cardiovascular disease in these young people."

Weiss said signs of an increased risk of future cardiovascular disease are already present in these youngsters and worsen with increased body mass index and insulin resistance. "We found that insulin resistance serves as a 'driving force' for the majority of components of the metabolic syndrome, similar to adults," said Weiss.

The study was funded by a grant to principal investigator

Sonia Caprio, MD, from the National Institute of Child Health and Human Development (NIH).

Other Yale authors on the study included James Dziura, Tania S. Burgert, MD, William V. Tamborlane, MD, Sara E. Taksali, Catherine W. Yeckel, Karin Allen, Melinda Lopes, Mary Savoye and Robert S. Sherwin, MD. John Morrison, MD is from Cincinnati Children's Hospital Medical Center. For more information: Karen Peart, 203-432-1326, karen.peart@yale.edu

Study Reveals Pediatricians Overlook Kawasaki Disease in Extremes of Pediatric Age Ranges

SAN DIEGO, CA -- Researchers at the University of California, San Diego (UCSD) School of Medicine report in the August 10 issue of Pediatric Infectious Disease Journal that a significant number of pediatric physicians fail to diagnose Kawasaki Disease (KD) in children younger than six months and older than eight years. This childhood disease is reported in about 5,000 children a year in the U.S.

First author, Pia Pannaraj, MD, UCSD pediatric resident, said a previous study showed that delayed diagnosis of Kawasaki Disease was a significant risk factor in the development of coronary abnormalities that can lead to heart muscle damage and deadly aneurysms.

"The purpose of the current study was to understand the basis of the delayed diagnosis," she said. "We wanted to know the cause so we could help make recommendations to prevent the delay and the subsequent coronary problems that can result."

The study's senior author Jane Burns, MD, Professor of Pediatrics, UCSD School of Medicine Department of Pediatrics, says the finding is significant because failure to diagnose and treat the disease at the extremes of the pediatric age range puts children at increased risk for coronary artery abnormalities and risk of heart attack later in life.

"Despite the availability of effective treatment for Kawasaki Disease, children continue to needlessly suffer preventable coronary artery damage associated with the disease," says

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Burns. "Numerous global studies have shown children can be at risk from as early as one month to their teens. General pediatricians and pediatric infectious disease specialists need to consider Kawasaki Disease when examining all children with prolonged fever accompanied by rash or red eyes, regardless of the patient's age."

Dr. Tomisaku Kawasaki of Japan, first diagnosed Kawasaki Disease over 30 years ago. Kawasaki Disease is characterized by inflammation of blood vessels throughout the body, and is accompanied by high fevers, rashes, bloodshot eyes, swelling of the hands and feet, redness of the mucous membranes in the mouth, throat and lips, and swollen neck lymph nodes. The disease and symptoms are treatable with gamma globulin. Full recovery can be made and heart damage prevented if treatment is begun within the first ten days. However, in cases where children have the disease and do not receive treatment, up to 25% can develop lethal coronary artery problems. Although researchers do not know the cause of Kawasaki Disease, they have discovered certain genetic backgrounds that affect KD susceptibility. The disease affects males almost twice as often as females. Kawasaki Disease afflicts children of all races, but physicians see it most often among children of Asian descent. The highest occurrences of the disease are reported in the winter and spring months with a second smaller peak in mid-summer.

For this study, Pannaraj and colleagues, Christena Turner, PhD, UCSD Department of Sociology, and John Bastian MD, Director of Immunology at Children's Hospital and Health Center - San Diego, sent a questionnaire to general pediatricians and pediatric infectious disease specialists listed in the American Academy of Pediatrics Membership Directory for San Diego County, the physician directories for San Diego's five major healthcare systems and the Pediatric Infectious Disease Society Membership Directory. Of the 227 general pediatricians and 651 pediatric infectious disease physicians contacted for the survey, 58.1% of pediatricians and 53% of pediatric infectious disease physicians returned the questionnaires.

Of the general pediatricians from San Diego County who responded, 57.3% did not consider a Kawasaki Disease diagnosis in children under six months of age, and 51.6% did not consider the disease in children older than eight. Of the pediatric infectious disease specialists who answered 26.5% did not consider KD in their diagnosis of children less than six months and 25% did not consider it in children over eight years of age.

According to Burns, the San Diego County Health Department Epidemiology Unit has documented 318 patients diagnosed with KD from January 1, 1998 to December 31, 2003. Of these patients, 8.3% were under 6 months of age and 18.1% were older than five years.

For more information visit the UCSD KD Research Program website at <http://www-pediatrics.ucsd.edu/kawasaki> or the KD Foundation website at www.kdfoundation.org.

New Survey Reports Children's Enrollment in SCHIP (State Children's Health Insurance Program) Coverage Dropped for the First Time in the Six-Year History of the Program

WASHINGTON, DC -- Reflecting both the economic downturn and the significant drop in state revenues over the past two years, enrollment of children in the State Children's Health Insurance Program (SCHIP) declined during the second half of 2003 for the first time since enactment of SCHIP in 1997 (see Figure 1). Enrollment declines in 11 states and the District of Columbia more than offset moderate increases in 37 other states, according to the new 50-state survey. More than half of the national enrollment decline is attributable to the drop in coverage in Texas.

The new report, SCHIP Program Enrollment: December 2003 Update, prepared with researchers at Health Management Associates for the Kaiser Commission on Medicaid and the Uninsured, finds that while annual enrollment in the SCHIP program increased by 4.2% in 2003, the increase was less than half the 9.7 % rate in 2002.

"The drop in SCHIP enrollment is a major set back when millions of uninsured children are eligible, but not yet enrolled in public coverage programs," said Diane Rowland, executive director of the Kaiser Commission on Medicaid and the Uninsured. "States have shown that bipartisan initiatives like SCHIP can work to reduce the number of uninsured children, but state budget constraints mean even this popular program has not escaped cutbacks."

The Kaiser Commission on Medicaid and the Uninsured provides information and analysis on health care coverage and access for the low-income population, with a special focus on Medicaid's role and coverage of the uninsured.

The new reports can be viewed at <http://www.kff.org/medicaid/kcmu072304pkg.cfm>



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HIGHLIGHTS OF THE CONGRESS OF THE SOCIETY OF LATIN AMERICAN INTERVENTIONAL CARDIOLOGISTS (SOLACI)

BUENOS AIRES, ARGENTINA -- The Congress of the Society of Latin American Interventional Cardiologists met at the Buenos Aires Hilton, August 4th—6th. Included among the over two thousand attending were two hundred pediatric and congenital interventional cardiologists from the Americas. Dr. Horacio Faella and Dr. Miguel Granja both of Buenos Aires, organized and hosted the sessions on congenital heart disease. Sessions were in Spanish or English and simultaneous translation was available in Spanish, English, and Portuguese.

Leading Latin American Cardiologists led round table discussions on several important topics. Dr. Felipe Somoza and Dr. Alberton Molina led the discussions and introduced presentations on stent/angioplasty of coarctation of the aorta. Dr. Daniel Gonzalez and Dr. Alejandro Peirone guided the discussions and introduced presentations on VSD closure. Dr. Rolando Gomez and Dr. German Henestrosa led the discussions and introduced the presentations on aortic valvuloplasty. The Round Table on ASD closure was conducted by Dr. Pedro Chiesa and Dr. Liliana Ferrin. The discussions and presentations on pulmonary artery angioplasty and stenting was led by Dr. Ricardo Sadi and Rolando Gomez. The discussions on PDA closure were led by Dr. Felipe Heusser, Dr. William Torres and Dr. Alberton Sciegata. Special presentations were made by the international guest faculty. Dr. Ziyad M. Hijazi discussed the current status of (muscular, membranous, and

post-infarct) VSD closure and PFO closure using the Amplatzer devices. Dr. John Cheatham discussed Hybrid Therapy as exemplified by Stage I treatment of Hypoplastic Left Heart Syndrome using transcatheter PDA stenting and bilateral surgically-placed pulmonary artery branch bands, and Stage III using the NuMed covered stent placed percutaneously. Dr. John Moore provided an update on the status of the Nit-Occlud device for PDA closure and described non-conventional uses of stents to palliate complex congenital heart disease. The highlights of the Congress were live cases which were broadcast from the Hospital Italiano where Dr. Cheatham and Dr. Granja performed a complex pulmonary artery stent/angioplasty. In the Fundacion Favalaro, Dr. Hijazi and Dr. Gamboa performed closure of a membranous VSD with aneurysm. Also, in the Fundacion Favalaro, Dr. Moore and Dr. Gamboa performed closure of a moderate-size PDA using a Nit-Occlud Device.

Many attendees were accompanied by spouses or friends, and the evening social activities were truly outstanding. Principal events were the Grand



From right to left: Dr. Miguel Granja, Dr. John Cheatham, Mrs. Granja, Dr. & Mrs. Horacio Faella, Mr. Mark Cibuzar, Director, International Sales & Marketing for AGA Medical, Dr. Ziyad Hijazi, and Mrs. John Moore.

Opening Gala at the Plais de Glace. The group was entertained by the Camerata Bariloche, a world renowned Barouche group. The Closing Gala was an unforgettable night of Tango at Senore Tango; the best known tango show in Buenos Aires. In addition, many tours were available during and after the meeting for interested attendees and guests.

Next year's SOLACI meeting will be in Mexico City, but Buenos Aires will host the PICS IX & ENTICHS III Meeting as well as the World Congress of Pediatric Cardiology and Cardiac Surgery next summer. <http://www.solaci.org>

For comments to this article, send email to: SEPSOLACI@PediatricCardiologyToday.com

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HEARTLAB'S ENCOMPASS AND PEDIATRIC CARDIOLOGY IMAGE ARCHIVING

By Ziyad M. Hijazi, MD

Pediatric cardiology images are traditionally the most difficult type of medical images to store and retrieve. Cardiology procedures produce larger and more complicated images than basic radiology procedures, and the nature of pediatric cases requires that more data be captured than for adult cases. In addition, a variety of regulations that vary by state, regulatory body and government agency require that pediatric images be stored for between 20 and 25 years.

Traditional film and video images are easily stored in offsite warehouses but are famously difficult to retrieve. Pediatric cardiac labs that have converted to digital imaging storage and management technology have taken a critical step towards easing the problem of pediatric cardiac image archiving. Digital technologies such as picture archiving and communications systems (PACS) have revolu-

"Pediatric cardiology images are traditionally the most difficult type of medical images to store and retrieve. Cardiology procedures produce larger and more complicated images than basic radiology procedures, and the nature of pediatric cases requires that more data be captured than for adult cases."

tionized image management by eliminating the need for offsite storage of older images.

Storage capacity and image retrieval

Despite its transformative effect, digital imaging must still take into account the size and volume of pediatric cardiology images. In fact, storage capacity is a major factor to consider in purchasing a cardiac PACS. If the performance and storage capacity of the system are not adequately addressed, it can result in long delays when retrieving older cases and can become a source of frequent end user complaints.

Online storage is attached directly to the imaging network and provides instant access to images. Because it provides the fastest access, it's also the most expensive type of storage. Depending on its IT budget and patient representing rates, a department may opt to keep three months or even five years of data online.

As images age, they are moved to what is known as the near-line archive – typically an attached tape or disk archive that takes a longer amount of time to access. Recordable DVD (DVD-R) has been adopted by the American College of Cardiologists (ACC) as the preferred method of archiving cardiology images.

Many different DVD-R storage strategies are available, but all are not equal. For example, some solutions manage the DVD-R archive with software that must be reconfigured each time an archive fills and a new one needs to be added. This is a fairly

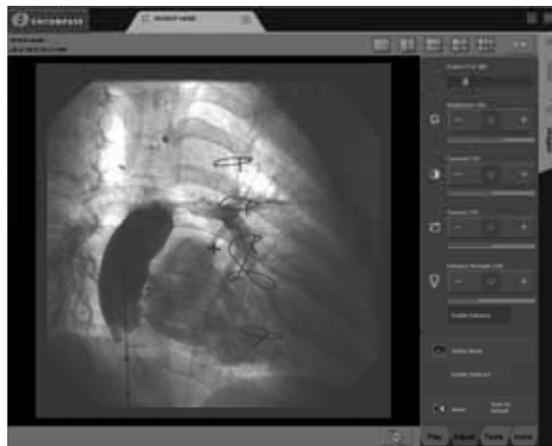


Figure 1. An angiogram in the frontal projection with slight RAO angulation in a 2.5 yr old patient status post fenestrated Fontan operation (Extracardiac conduit) demonstrating mild narrowing at the origin of the left pulmonary artery and right to left shunt via the fenestration.

complicated process that most users prefer to bypass by determining how much storage is needed, and buying it in advance – obviously an expensive up-front solution. A better approach is a modular solution that allows additional DVD-R archives to be easily and transparently connected to the system as the older archive reaches its capacity. This allows facilities to pay for storage as they need it.

In some systems, offline storage may be required but is not a preferred alternative. Offline storage involves removing tape or disk media from a near-line archive and separately archiving it. Such a scenario is comparable to offsite storage of film and video images and is only adequate when budget issues prevent a department from purchasing additional near-line archives.



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Other considerations

Besides storage capacity and retrieval speed, there are several other critical elements in evaluating a cardiac PACS.

Vendor interoperability. The most flexible cardiac PACS interoperate with equipment from all manufacturers. In recent years, the imaging technology industry has pushed its vendors to create systems compatible with the Digital Imaging in Communication and Medicine (DICOM) standard, which are interoperable with equipment from all vendors.

Image quality. Physicians expect high-quality images at every workstation. This includes diagnostic quality workstations located within the pediatric cardiology department, as well as those at remote sites that are used for accessing the image archive via an Internet connection.

Disaster recovery. Both HIPAA and JCAHO mandate data backup and disaster recovery plans for all health-care organizations. Cardiac PACS should provide an automated solution for duplicating archived images, enabling them to be stored offsite in case of an emergency.

Overview of Encompass from Heartlab

Using a cardiac PACS from Heartlab, Inc., the pediatric cardiology department of the University of Chicago Children's Hospital annually archives approximately 500 cardiac catheterization exams. Known as Encompass, the Heartlab system can archive images from both invasive and non-invasive modalities as well as non-imaging data such as measurements and other text-based information.

Encompass allows pediatric cardiology staff to:

- Import patient admissions data

- Acquire DICOM images
- Retrieve, view and interpret digital cardiac images and information
- Compare multiple images from multiple modalities
- Generate and distribute physician's reports
- Access images from remote workstations using a secure Internet connection

In a typical Encompass installation, workstations are placed in strategic locations throughout the facility. Optional software allows Encompass workstations to be installed in clinician offices to provide remote access to high-quality images and reports via a secure Internet connection. Retrieval times are the same, regardless of the location of the workstation. Encompass can create DICOM-formatted DVDs so that patients and other users can view images using any offline PCs.

Patient data is stored in a single, integrated database. Advanced Encom-



Figure 2. Repeat angiogram after placement of a stent in the left pulmonary artery (LPA) and device closure of the fenestration demonstrating no residual narrowing in the LPA and no residual right to left shunt.

pass modules allow users to query the database and extract data to produce a variety of clinical reports. For example, a researcher could search the Encompass database to determine the number of children between the ages of 3 –13 who had been treated for coarctation of the aorta. Moreover, it provides a longitudinal view of a patient's care that facilitates physician decision-making and eliminates the time needed to retrieve older studies.

Encompass features and benefits

Storage capacity and image retrieval. Using DICOM to communicate with multiple modalities such as X-ray angiography, ultrasound, nuclear medicine, computed tomography and magnetic resonance imaging equipment, Encompass can store data on existing online network storage or near-line DVD-R archives provided by Heartlab or another manufacturer. Whether a study is three months or three years old, it can be accessed very quickly using Encompass.

“With digital cardiac PACS, pediatric cardiologists and clinical staff now have an image storage and management solution that helps eliminate the problem associated with archiving large, complicated, pediatric cardiology studies.”

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Images stored on the online network can be retrieved instantaneously, while the Encompass DVD archive permits users to retrieve images in less than 60 seconds – the fastest access time for cardiac images in the

“...the pediatric cardiology department of the University of Chicago Children’s Hospital annually archives approximately 500 cardiac catheterization exams.”

industry. In fact, when the file size of an angiogram quadrupled due to new high resolution flat panel cath lab technology, Heartlab was the only vendor whose network could retrieve the image from the near-line archive in less than 60 seconds.

In addition, Heartlab’s modular DVD-R archive allows users to add storage as it is needed, eliminating the upfront expense of an unneeded storage. When a new Heartlab DVD-R archive is added, no system reconfiguration is needed and the addition is unnoticed by the end user. By providing near-instant access to a modular near-line DVD archive, Heartlab enables facilities to spend less budget dollars on expensive online storage without sacrificing operational efficiency or end user satisfaction.

Interoperable with other vendors. Encompass is fully compatible with all DICOM-compliant modality equipment and other PACS. It also uses industry-standard protocols such as Health Level 7 (HL7) and Structured Query Language (SQL) to interface with hemodynamics systems, hospital information systems and clinical databases.

High quality images. Encompass pro-

vides diagnosis-quality images at all workstations. Encompass preserves true 1024 x 1024 DICOM imaging and supports 8-, 10-, 12-, and 16-bit X-ray images. In addition, Encompass offers extremely high quality images at remote workstations that access the network through a secure Internet connection.

Disaster recovery. Encompass protects data by providing integrated disaster recovery with the automated creation of duplicate archive media for off-site storage. The duplicated data is DICOM compatible for immediate access with no additional software.

Conclusion

With digital cardiac PACS, pediatric cardiologists and clinical staff now have an image storage and management solution that helps eliminate the problem associated with archiving large, complicated, pediatric cardiology studies. Such technologies help pediatric cardiologists improve the quality of patient care and optimize patient outcomes, while reducing the cost of healthcare and boosting staff productivity and efficiency.

For comments to this article, send email to: SEPZMH@PediatricCardiologyToday.com

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HeartLab

Founded in 1994, Heartlab is the world’s leading designer and supplier of digital image and information networks for cardiology. Heartlab develops application software and integrates systems using industry-standard computer hardware, including Heartlab’s own StoreSafe® DVD-R archiving and Oracle’s database technology. Heartlab’s Encompass™ network gives cardiologists rapid access to imaging exam and report information, enables cardiology centers to operate more efficiently and provides robust protection for critical patient data. Heartlab’s networks are installed in more than 250 of the nation’s leading heart centers.

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