

# CONGENITAL CARDIOLOGY TODAY

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## LINKED BY A COMMON PURPOSE: GLOBAL EFFORTS FOR IMPROVING PEDIATRIC HEART HEALTH:

### A REPORT BY CHILDREN'S HEARTLINK

By *Bistra Zheleva, International Programs Coordinator, Children's HeartLink*

Children's HeartLink is an international non-governmental organization whose mission is to support cardiac centers in developing countries to enhance and expand sustainable pediatric cardiac programs so more children have the opportunity to receive quality treatment for congenital and acquired heart disease in their own countries.

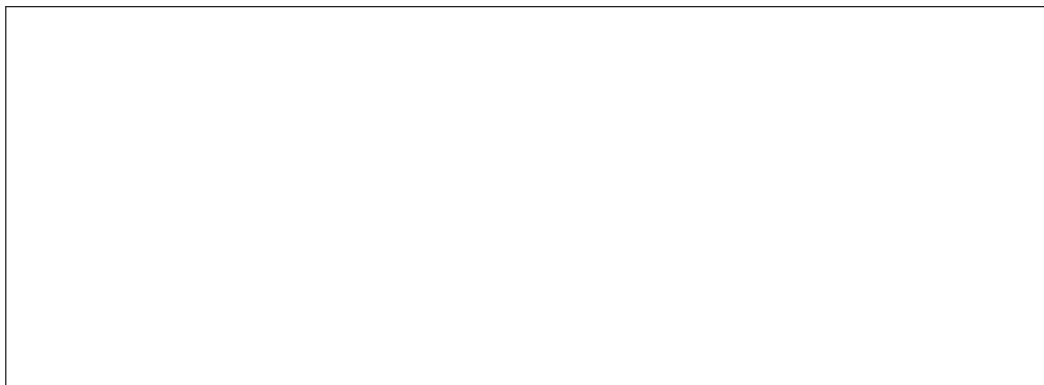
In 2005 we published the first edition of what we envisioned to be a series of reports on the state of pediatric cardiac services in the developing world. The 2005 Children's HeartLink report, "To Save a Child," gave an overview of acquired and congenital heart disease and the impact these diseases have on children in the developing world. This year we are publishing the second report in which we offer a more in-depth look at congenital heart disease, and in particular, the factors that make its diagnosis and treatment so difficult outside of the developed world.

As was noted in the first publication, the needs of children with heart disease in the developing world are both understudied and un-responded

to. We have tried in this second publication to again gather some of the latest thinking on pediatric heart disease and the challenges in addressing it in underserved regions of the world.

The first section of the report discusses factors in treatment and detection of congenital heart disease in the developing world. The second is a shorter discussion of acquired heart disease in children, spotlighting two rheumatic heart disease prevention projects, one in India and one in the Pacific Island of Fiji and a Chagas disease prevention project in Ecuador. There is a discussion of the relevance of the United Nations Millennium Development Goals to children's heart disease in the developing world, as well as one about the effect the health worker migration crisis has on pediatric cardiac care in the developing world. The last section discusses the results from a web survey conducted to explore the views of practitioners in the field of pediatric cardiac care concerning the challenges in the successful treatment, detection and prevention of pediatric cardiac disease.

For the purposes of this article we will focus on our findings on congenital heart disease, the web survey findings, and the health workers migration crisis.



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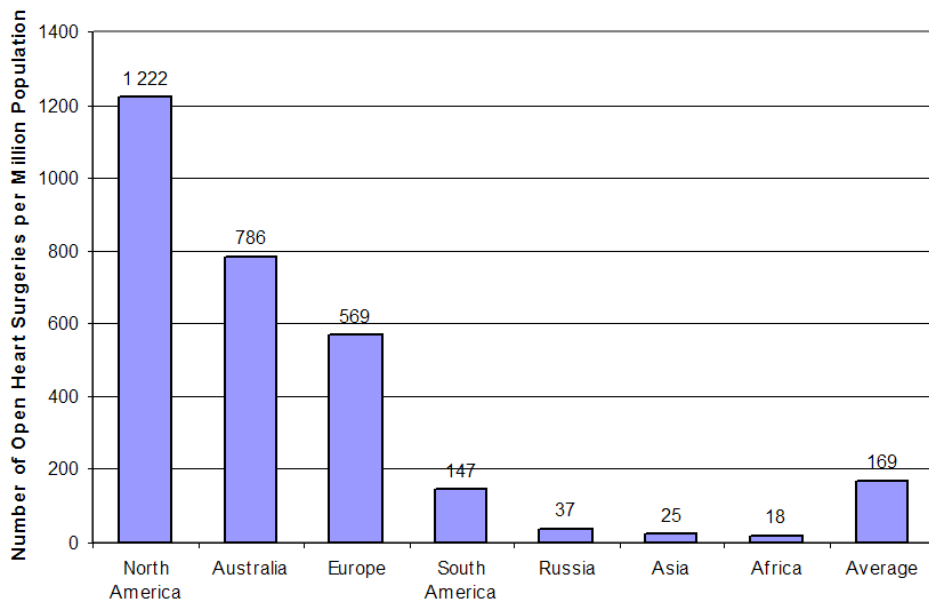


Figure 1: Number of open-heart operations per million people in selected regions.

**Congenital Heart Disease**

In 2001, childhood deaths from congenital abnormalities in developed countries, while still 20% of total childhood mortality, totaled approximately 20,000 children. However, congenital abnormalities in low-income countries, while only 3.7% of total mortality, took the lives of over 440,000 children. Even though congenital heart diseases account for only some of the congenital anomalies in these estimates, the overall pattern of childhood mortality undoubtedly holds when considering only congenital heart lesions in high-income versus low-income countries: more children die of congenital heart disease in low-income countries than in more developed countries.

**Factors Preventing Diagnosis and Treatment of Congenital Heart Disease in the Developing World**

**A. Lack of Access to Cardiac Care**

A basic obstacle to treating pediatric cardiac diseases is that cardiac treatment is simply inaccessible to most of

the world's population. Worldwide, there are over 4,000 medical facilities specifically equipped to support cardiac surgery, and more than 6,000 cardiothoracic surgeons conduct between 2 and 2.5 million open heart surgical operations per year. However, the vast majority of these operations occur in the developed world (see Figure 1) and these heart centers are predominately located in the West. At most, they serve perhaps only seven percent of the world's population. In addition, approximately one facility capable of open-heart surgery exists for every 120,000 people in North America, and one center for every million people in Europe and Australia; however, there is only one center per 16 million people in Asia. Africa is the most underserved by cardiac care facilities: on average, there is only one center per 33 million Africans with the facilities, equipment, and staff capable of supporting open-heart operations and advanced cardiac care. Combined, these statistics indicate that there is only one cardiac

care center per 1.4 million people worldwide.

**B. Few Facilities to Treat Pediatric Heart Disease**


While there are few general cardiac care facilities (mostly in urban areas), even fewer have the capacity to treat children, particularly young children and infants, with heart disease. When two thirds of the world's population has no access to advanced cardiac care for adults, access to cardiac care is even scarcer for children and infants with CHD.

**C. Shortage of Trained Pediatric Cardiac Specialists**

Compounding the lack of access to cardiac facilities outside of the developed world is the fact that very few doctors or medical specialists have any training in treating pediatric heart disease, particularly in very small children or neonates. There are limited opportunities for training in pediatric cardiac care outside of the advanced medical centers that specialize in cardiac care for children. Often, pediatricians in most parts of the developing world are not familiar with the presentation of severe CHD at birth or early infancy, so only a small fraction of the heart defects present at birth are detected and the early signs of CHD may be missed.


**D. Prohibitive Expense of Pediatric Cardiac Treatment**

While there are pockets of affluence in almost all countries that can afford high-quality health care, the vast majority of people in the developing world cannot afford to pay for surgery and hospital fees if their children are born with heart disease. In a world in which one in five people subsist on less than 1 US dollar a day, advanced medical treatments for CHD are simply out of reach for the vast majority of the world's people.



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### E. Lack of Basic Health Care

The inability of most of the world's population to receive cardiac treatment is merely emblematic of a much larger problem. Over 80% of modern health care is performed in the countries of North America, Western Europe, and the developed countries of Asia. Because the Western world represents only nine percent of the total world's population, most of the world's people are left with little or no access to advanced medical treatments. Treatment of CHD requires expensive infrastructure that most government health-care systems cannot afford and many countries often choose to devote the few resources they have to more readily treatable pediatric health problems.

### F. Shortage of Health Care Workers

Not only are most of the world's surgeons and cardiac specialists concentrated in the Westernized world, most of the world's doctors and medical personnel are predominately found in more industrialized countries. According to the World Health Organization, the United States (US) and the United Kingdom (UK), have an average of 21.3 doctors and 27.9 doctors per 10,000 citizens, respectively. In comparison, India has 5.9 doctors per 10,000 people (Southeast Asia has 5.0 per 10,000), and Kenya has only 1.3 doctors per 10,000 people (Africa has an average of 1.8 per 10,000 citizens). In addition, while the US and UK have 125.1 and 75.2 health care workers per 10,000, India, and Kenya have only 13.8 and 10.3, respectively.

### G. Migration of Health Care Workers to Developed Countries

"Brain drain," the persistent loss of medical workers to more developed countries, is a major issue for many countries that cannot compete with the wages, opportunities, and advanced facilities of richer

nations. The shortage of health care workers is a worldwide issue, with an estimated shortfall of over 4.3 million workers globally. Sub-Saharan Africa has the most severe shortage, with only 3% of the world's health care personnel. This shortfall is particularly serious, as this region has 11% of the world's population and 24% of the world disease burden.

### H. Lack of Investment in Public Health Sectors

Under-investment in health care in developing or underdeveloped countries has led to poorly-developed health infrastructures that do not offer enough jobs to absorb the number of available health care workers. While the US spends 5,274 US dollars per person, India, with a population of over 1 billion, spends only 96 US dollars per person or 4.4% of its total government spending, on health care.

### I. Competing Priorities in Health Care

Treatment of pediatric cardiac diseases requires an expensive health infrastructure and specially trained staff, which most government-sponsored health institutions in developing countries are unable to afford. Over time, the lack of investment in health care has created a situation in which poorly staffed facilities with few resources are often unable to provide anything more than primary health care. The existing public health systems in many of these underdeveloped countries are already struggling to deal with widespread malnutrition and outbreaks of common communicable diseases, such as malaria and tuberculosis and many health care systems are stretched beyond their limits as they deal with the AIDS epidemic.

### International Strategies to Treat Congenital Heart Disease

Because so many countries' medical systems are unable to afford treatment for



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children with congenital heart diseases, the international community often steps in to offer treatment for these children and infants. Numerous nonprofit and non-governmental organizations, as well as hospitals and institutions, work with facilities in developing countries to provide interventional techniques and cardiac operations available for children. Many of these organizations have been working in other countries for years, while others have begun their partnerships with overseas hospitals more recently. The ways in which these organizations offer treatment has also changed over the years and modes of delivery for treatment have evolved as costs of health care and transportation change. The four major strategies employed by international organizations to treat children with pediatric heart diseases in developing countries are:

1. Transporting children with heart disease to other countries for treatment
2. Sending surgical teams to developing countries to carry out treatment
3. Training local doctors and staff in developed countries
4. Creating regional centers for treatment of pediatric heart disease

In addition to continuing their current activities, the report's two main recommendations for international organizations involved in charitable assistance for children with heart disease are:

1. Coordinated efforts between organizations, individuals, facilities, and partner hospitals around the world to consolidate their efforts.
2. Advocacy for increased international assistance. Organizations that treat congenital heart disease can potentially make a greater long-term impact on addressing CHD in developing countries if they use their influ-

ence to advocate together for greater investment in health care for the developing world. Their advocacy can help keep the issue of poor children with pediatric heart disease on the international community's agenda. Only if congenital heart disease comes to the attention of the policy-making international community will this issue receive enough attention to increase foreign assistance for international health in general, and for treatment of CHD in particular.

**Managing the Health Worker Migration Crisis**

In order for a young heart patient to receive top-quality medical assistance, she needs an entire medical team of trained professionals providing her care. When medical teams lose and cannot replace experienced staff in a timely manner, that patient's cardiac care is compromised. In the developing world, where often the hospitals are under-resourced and staff is poorly paid and works long hours, maintaining quality personnel is even more difficult.

According to the WHO, there are 57 countries with health care systems on the verge of collapse due to staff shortages. More than four million additional health workers are needed, in these countries, to fill personnel gaps. More than half of these additional workers are needed in Sub-Saharan Africa, an area of the world that shoulders 24% of the world's disease burden, 11% of the world's population and only 3% of the world's health workers.

Research shows there are currently four methods for managing health workers migration utilized by the international community:

*Retaining Health Workers*

Although low salary is an impetus for nurses and other health professionals to



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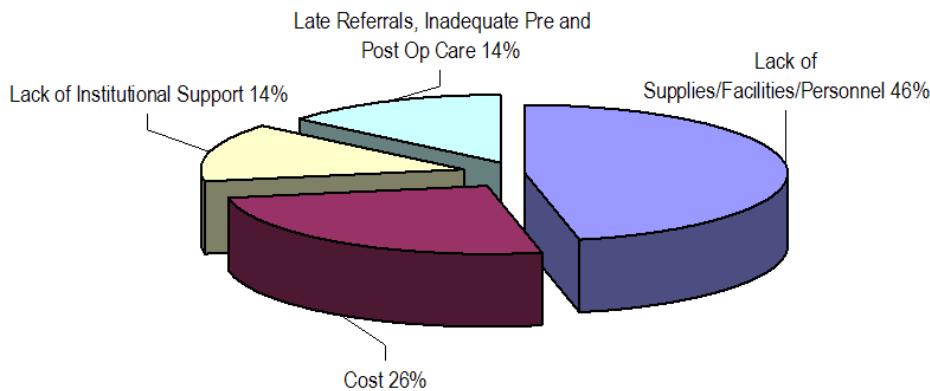


Figure 2: What do you consider the greatest frustration/challenge when you work to treat children with heart disease in developing countries? - Children's Heartlink Web Survey.

the local pool of qualified health professionals, the pressure to recruit workers from developing countries will decrease.

*Restraining Health Workers from Leaving*

One solution to discourage unwanted migration is bonding. Bonding asks those that have benefited from government financial assistance – for example, physicians that have received government loans or grants for their training – to pay back their cost of training if they are unable or unwilling to serve a minimum number of years in their own country.

*Abstaining from Unethical Recruitment*

The UK has been a leader in instituting codes of conduct regarding the ethical recruitment of health professionals from medically underserved countries. Starting in 1999, the UK's Department of Health has discouraged its National Health Service (NHS) from directly recruiting health professionals from South Africa and India. Since then, the NHS has included additional nations on the list. Ultimately, the strength of the code of conduct rests upon its enforcement which, according to many developing countries, is weak.

**Pediatric Cardiac Survey Results**

In preparation for this publication, Children's HeartLink conducted a web survey reaching out to the pediatric cardiac community to identify the biggest obstacles in effectively addressing the burden of CHD in the developing world. Cardiac surgeons, cardiologists, and others working in the field of pediatric cardiac care from over 90 countries were invited to participate by email.

When asked to list the biggest frustration/challenge in working to treat children with heart disease in the developing countries, most responses fell into four general categories (see Figure 2):

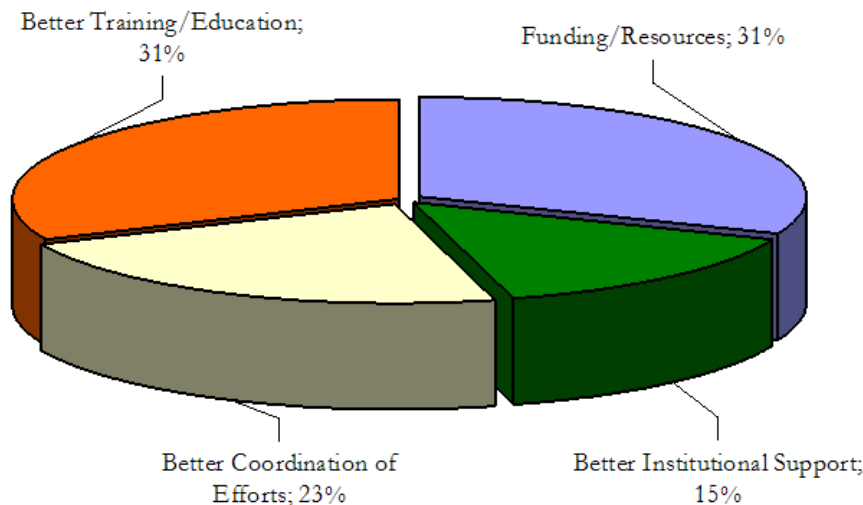



Figure 3: What do you think the International donor community ( NGOs, government, intergovernmental organizations, community health organizations, etc.) can do to better treat and prevent pediatric heart disease in developing countries? - Children's Heartlink Web Survey.

consider working abroad, offering health workers a clear job description, feedback on performance, fair supervision and on-the-job training has proven to improve job satisfaction and, in turn, performance as well. While more pay would be welcome by many health workers, simply receiving payment on time and in full builds confidence between worker and institution.

*Training Local Professionals Inside the Country*

For years, countries such as the US, UK, Canada and Australia have relied upon foreign countries to train up to a quarter of the physicians that their nations need. Efforts are now underway, within developed nations, to increase the number of locally trained health professionals. The hope is that by increasing



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1. Lack of general health infrastructure including, lack of trained medical personnel, lack of supplies and equipment, lack of medicines and other supplies;
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4. Late referrals and inadequate pre- and post-operative care.

Another big frustration appeared to be the patients' ability to pay for their treatment, which can be directly related to poverty and poor health care support in the developing world. Yet again, it brings back the issues of health system and infrastructure and government support for health care.

The findings in this survey suggested that children's heart disease remains a largely unmet challenge in the developing world. Among the factors that contribute to it, lack of funding for treatment and supplies and equipment top the list. However, the cost of the treatment and the costs of investing in a tertiary health program suggest that it can be prohibitive for many hospitals to even start developing pediatric cardiac centers. Many may consider the challenge of primary care needs to take precedence over the development of tertiary programs such as pediatric cardiac care.

Another issue that surfaced was the lack of trained personnel, as discussed earlier. Shortage of trained personnel affects the quality and quantity of health services and directly affects pediatric cardiac programs in many developing countries. Many respondents mentioned that losing trained personnel to hospitals in the developed world has been a significant challenge in providing sustainable, quality pediatric cardiac care.

The respondents were also asked to describe programs that have been successful in treating and preventing pediatric heart disease in the developing world. The most often cited components of a successful program were commitment to pediatric cardiac care, good communication among the cardiac team members, and stable financial support from a variety of sources.

The last question of the survey addressed suggestions for the international community involvement in addressing the treatment and prevention of children's heart disease in the developing world. The responses could be grouped in the following general categories (see Figure 3):

1. Better training and education for cardiac professionals
2. Lack of funding and resources
3. Better coordination of efforts to support pediatric cardiac care



### Adult Congenital Heart Disease Specialist

The Division of Pediatric Cardiology of Sanger Clinic and Levine Children's Hospital in Charlotte, NC is recruiting an adult congenital heart disease (ACHD) specialist to help direct a busy and growing service. The successful applicant should be board certified/eligible in pediatric cardiology and preferably have completed a specialty fellowship in ACHD. The successful applicant will join a rapidly growing practice of seven pediatric cardiologists and two cardio thoracic surgeons. The Sanger Clinic also has a large and busy adult cardiology practice with several adult cardiologists involved in the ACHD service. The candidate should have excellent interpersonal skills and ideally an interest/expertise in imaging, particularly magnetic resonance imaging.

The Sanger Clinic is the largest congenital heart center in North Carolina performing three hundred surgeries and three hundred cardiac catheterizations per year. The practice is affiliated with Carolinas Healthcare System, the fourth largest hospital authority in the country, but operates much like a private practice with very competitive compensation and benefits. The hospital authority is poised to open Levine Children's Hospital in the fall of 2007, an eighty-five million dollar state-of-the-art facility. Interested applicants should fax or e-mail their CVs to Dr. Stern.

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#### 4. Better institutional support – work with national and local governments

All four categories can be viewed as interdependent and most respondents touched on at least one of them.

The rates of congenital heart disease are not significantly different between developing and developed countries. However, the fact it does not get diagnosed or treated in the developing world as early as in developed countries creates a backlog of untreated heart disease cases. In addition, acquired heart problems such as rheumatic heart disease, almost eradicated in the developed world, still is very prevalent in some developing countries. Another dynamic contributing to this issue is the disproportionate attention paid to adult cardiac disease as opposed to pediatric.

#### Conclusions

While children's heart diseases are only one of a myriad of health problems facing poor and underdeveloped countries, they are intrinsically linked to many of the other health problems in the developing world. International organizations have a unique position when it comes to dealing with major issues, whether they are of a medical nature or not. Nonprofit organizations can treat problems at a local level, and may have a more objective position than many governments would on the issues that surround problems and prevent finding easy solutions. Organizations can also act on a global level, and can use their influence and their high profile within their home communities to advocate for greater attention and assistance to address problems. They must begin to advocate for increased foreign investment in both tertiary medical centers and health care infrastructure, as well as for the creation of national health care policies that include pediatric heart disease management. Organizations can also increase their effectiveness by working with other nonprofits or institutions to improve their outreach, increase their efforts,

and better direct their resources and skills to where they are most needed. The international community of donor and recipient governments, nongovernmental organizations, and international agencies must work together to address the root causes of poor health care in developing countries.

Congenital and acquired heart diseases affect millions of children around the world, but the majority of them will never receive the treatment they need. These children have no access to treatment, not only because of a lack of access to cardiac care, but also because of a general lack of socioeconomic development and health care investment in their countries. These factors work together to create poor public health systems, a lack of medical training, and a shortage of health care workers that prevent children from receiving corrective treatment. Pediatric heart disease is a serious issue, but it is not a problem created in a vacuum. Only when it is placed within the global context of economic and health care disparities will the international community be able to make real strides toward reducing the prevalence of acquired pediatric heart disease and improving the diagnosis and management of congenital heart disease. Only when we improve health care for entire regions of the world will we ensure that all of the world's children with heart disease can access and receive the medical care they need to live normal, healthy lives.

For the last 40 years Children's HeartLink has been dedicated to the mobilization of global resources to prevent, treat and cure children's heart disease. We hope that this report contributes to the knowledge and understanding of pediatric heart disease and the efforts to offer greater access to its prevention and treatment in underserved regions of the world. With this report, we hope to further the knowledge of the field and come closer to preventing and curing cardiac heart disease for all of the world's children.

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To receive a copy of the full report and full list of references please go to [www.childrensheartlink.org](http://www.childrensheartlink.org) or contact the author.

~CCT~

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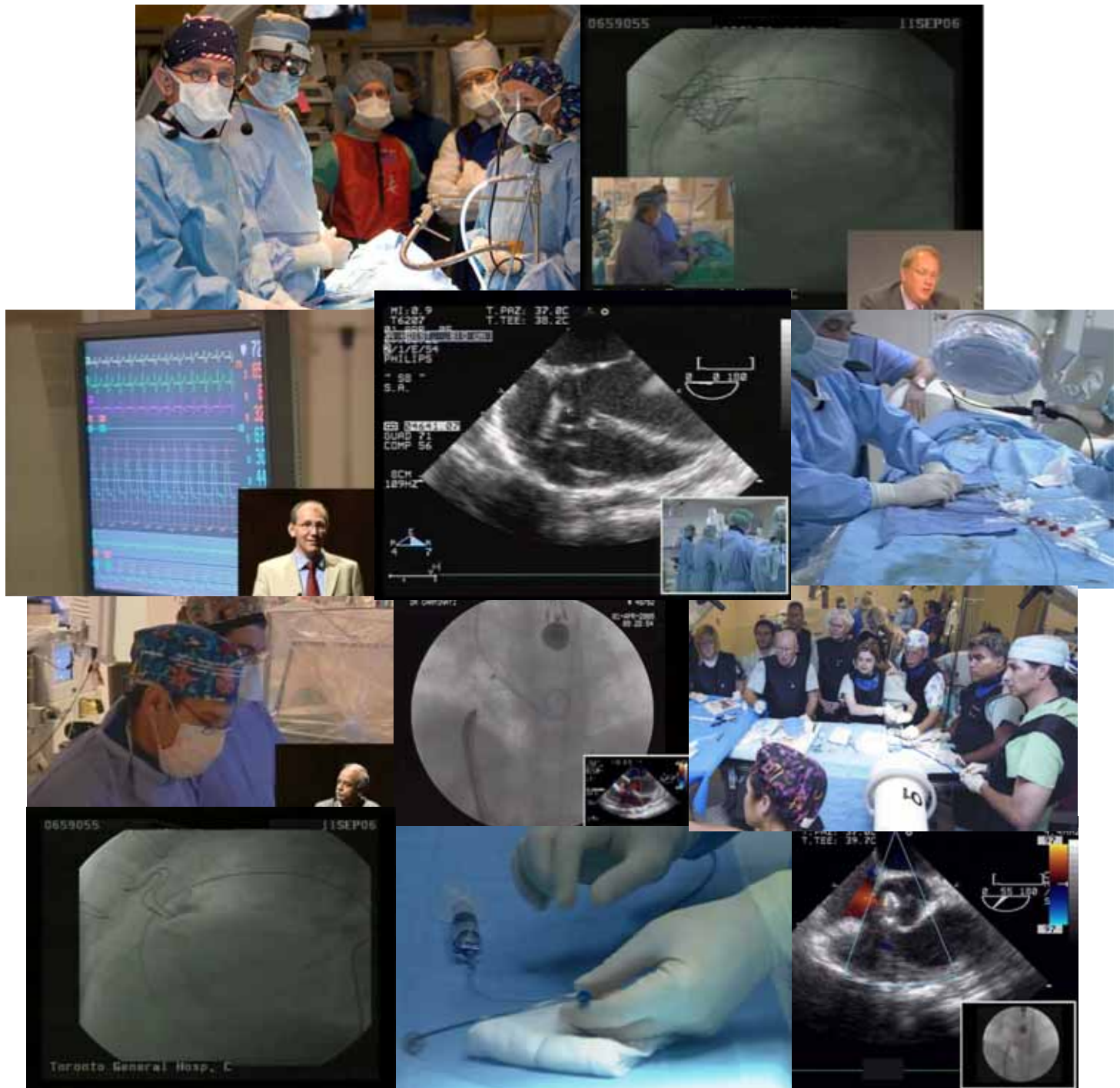
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## HIGHLIGHTS FROM THE WESTERN SOCIETY OF PEDIATRIC CARDIOLOGY ANNUAL MEETING

By Paul D. Grossfeld, MD

The Western Society of Pediatric Cardiology held its annual meeting on April 20-22, 2007 at the Four Seasons Hotel in Las Vegas, Nevada. One hundred ten members from 12 states attended. Twenty-four invited speakers gave presentations on a diverse range of topics.

The meeting began with a historical account by Dr. William Evans (U. of Nevada), the meeting's host and organizer, on two women pioneers in pediatric cardiology: Dr. Maude Abbott and Dr. Helen Taussig. The first session, Surgery I, was led off by Dr. James Tweddell (U. of Wisconsin). Dr. Tweddell described his ten year experience with infants with HLHS. He emphasized the importance of monitoring SVO<sub>2</sub> as an indicator of SVR. He reported 93% survival on their series of 116 consecutive patients. He also reported that SVO<sub>2</sub> < 40% correlated with poorer neurodevelopmental outcomes, as indicated by visual motor impairments. Lastly, he described their success in systematic home monitoring, which has been associated with an interstage one/two mortality decrease from 15 to 3%. The next presentation was by Dr. Howard Rosenfeld (Oakland), who discussed imaging modalities for assessing defects of the left ventricular outflow tract. He showed examples of transthoracic and transesophageal echocardiography, along with MRI and 64 slice CT for assessing SubAS, HCM, intracardiac masses, AVCD with LVOT obstruction, aortic valve defects (including critical AS in the fetus), SVAS, and IAA/VSD with LVOT obstruction. The last talk of the session was by Dr.

Michael Ciccolo (U. of Nevada), who discussed surgical management of LVOT obstructive lesions. These lesions included valvar, supra-valvar, subaortic, and multiple levels. Dr. Ciccolo described a variety of surgical techniques to address these lesions, including several variants of the Konno procedure.

The next session was on electrophysiology. The first talk was by Dr. Ian Law (U. of Nevada) on newborns with Long QT syndrome. After providing an interesting historical account of LQTS, he described how risk stratification correlates with QTc length. He also discussed the challenges of calculating reproducibly the QTc, treatments, and genetic testing. He cited recent studies which indicate that about 10% of all SIDS cases are likely to be due to undiagnosed neonatal LQTS. Lastly, he discussed the possibility of performing screening EKGs on infants to detect LQTS. The data suggest that, in particular, due to the high number of false positives, screening EKGs are probably not cost-effective at this time. The next talk was by Dr. David Bradley (U. of Utah) on newborns with preexcitation. Dr. Bradley discussed the anatomy, epidemiology, and association with congenital heart defects. He then discussed the natural history, and described the relatively low risk of sudden death, especially in younger children. Lastly, he discussed management strategies, including the relative contraindications for using digoxin or calcium channel blockers. The last talk of the session was by Dr. Mitchell Cohen (U. of Arizona) on incessant tachycardias. These included those involving the atrial

level (ectopic atrial, chaotic atrial, and AV node re-entrant), AV node (congenital junctional ectopic tachycardia), and ventricular. He mentioned that congenital JET has been reported to have an overall mortality of 35%. He also discussed permanent junctional reciprocating tachycardia, which only accounts for 1% of pediatric SVT, but is notoriously difficult to manage medically. Finally, he discussed ventricular tachycardias, for which he reserves medical treatment only for those with symptoms. He recommended ablation procedures only for those patients with ventricular tachycardias that are refractory to medical management. Overall, outcomes are favorable, particularly in patients with a structurally normal heart.

The evening session was highlighted by a fascinating discussion and debate between Dr. Frank Hanley (Stanford) and Dr. Jane Somerville (Royal Brompton Hospital, London), on the management of patients with TOF/PA/MAPCAs. The spirited discussion focused on whether any or all patients should be operated on at all (Dr. Somerville), versus early surgical intervention on most patients (Dr. Hanley). Dr. Somerville cited historical data from her institution, which demonstrates 50% survival at age 35 years in patients that did not have surgery. Dr. Hanley presented his surgical outcomes: over a 15 year period, 358 patients were operated on with 5.9% early mortality, and 7% mid-late mortality. The ten-year actuarial survival was 86%. Both agreed that the jury is still out on whether Dr. Hanley's outcomes will indicate that patients do better with surgery by age 35 than those that do not have surgery. Nonetheless, Dr. Somer-



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*Drs. Frank Hanley and Jane Sommerville (left to right).*

ville most eloquently acknowledged that if Dr. Hanley were the surgeon at her institution, she would send all of her TOF/PA MAPCAS to him. Well said!

The second day consisted of four sessions: Pulmonary hypertension, Molecular mechanisms to clinical care, Surgery II, and then a fellows' session. The first talk of the morning session was by Dr. Jacqueline Szmuszkovicz (USC). She provided an outstanding overview of the most current medical therapies for pulmonary arterial hypertension. These include those affecting the endothelin pathway (endothelin receptor antagonists), as well as medications affecting the nitric oxide pathway, including phosphodiesterase 5 inhibitors, and finally, prostacyclin. She stated that chronic prostacyclin can benefit those deemed to be medical non-responders. Finally, she mentioned that studies involving combination therapies are currently underway. The second lecture was by Dr. Brian Reemtsen (USC), who discussed live donor lung transplant for pulmonary arterial hypertension. He stated that lung transplantation should not be considered the futile therapy it has been in the past. At USC, 88 bilateral lung transplants have been performed, with a 5-year survival of 58%. Interestingly, there is virtually no difference in survival between living donor and cadaveric transplants. Dr. Reemtsen reiterated the fact that many lung transplant recipients can live a good quality of life. The last talk of the early morning session was by Dr. Jane Somerville (Royal Brompton Hospital, London), who provided a fascinating fifty-year historical account of the many



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pioneering congenital heart surgeons with whom she has interacted.

The late morning session led off with a talk by Dr. Ian Adatia (UCSF), on Beta-Naturetic peptide in congenital heart disease. First, he provided an historical account of how BNP was identified. He then discussed how BNP levels can be used to predict post-operative outcomes. In neonates, he cited that high post/pre surgical BNP ratios are predictive of poor outcomes. He also stated that data indicated that BNP cannot be used to predict when a patient can be weaned off of ECMO. However, the level of BNP in patients on ECMO during a trial off, compared to the pre-trial off level, was predictive of the need for surgery and death within three months of being on ECMO. The second talk was by Dr. Amy Sehnert (Stanford). Dr. Sehnert provided a comprehensive overview of current genetic testing for the following disorders/lesions: Williams Syndrome (Elastin), TOF/PA/MAPCAS (22q11), Long QT Syndrome, Preexcitation (PRKAG2), Pulmonary hypertension (BMPR2), Atrial septal defects (NKX2.5), Noonan Syndrome (PTPN11, KRAS, SOS1), and Pompe Disease. She cited a very useful website which lists all laboratories worldwide that perform genetic testing: [www.genetests.org](http://www.genetests.org). The last talk of the session was by Dr. Paul Grossfeld (UCSD), who presented real cases that demonstrated how understanding the genetic basis of specific congenital heart defects can be translated into improved clinical care. He described a family with multiple affected members with atrial septal defects, and one with HLHS that has a mutation in NKX2.5, and how there is a subset of patients with these lesions that are genetically predisposed to the development of progressive heartblock. He also discussed how 30% of siblings of patients with HLHS have congenital heart

defects and recommended that all first degree relatives of patients with HLHS have screening echocardiograms. Lastly, he gave an update on the genetics of Marfan Syndrome, and mentioned that there is a new study through the pediatric heart group that is testing the possibility that Losartan, an AT1 receptor antagonist, may prevent the development of cardiovascular problems in these patients.

The first talk of the third session, Surgery II, was a brief overview by Dr. Masato Takahashi (CHLA) on the new guidelines published electronically in Circulation (April 19, 2007) for the Prevention of Infective Endocarditis. Next was an interesting talk by Dr. Francois Lacour-Gayet (U. of Colorado), who discussed the history of the Aristotle Scoring System for measuring surgical outcome of patients with congenital heart disease. One of the ongoing challenges that he described is how surgical morbidities are defined and quantified. Another limitation is that these statistics have not predicted mortality, but only evaluated performance. There are currently 47 participating centers from around the world. More recently, a new score factors in mortality and morbidity index, which gives a so-called technical difficulty score. The next talk was by Dr. Norman Silverman (Stanford), who gave a comprehensive presentation on how echocardiography can be used to employ a segmental approach for identification of the anatomy and physiology of single ventricle patients. The last talk of the session was by Dr. John Nigro (Saint Joseph's Hospital, Arizona), on the management of pulmonary blood flow in the univentricular heart. He reviewed how, for single ventricles like tricuspid atresia, HLHS, and double inlet left ventricle, there is a balance between pulmonary and systemic blood flow. This, in turn, is determined by the relative pulmonary



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and systemic vascular resistances. He briefly discussed the advantages and disadvantages of pulmonary artery banding, and how early DKS can be safe for a subset of patients. He concluded by discussing the need for early control of pulmonary bloodflow for a successful Fontan outcome.

The last session consisted of two talks by current fellows. The first talk, by Dr. Miwa Geiger (UCLA), discussed the utility of monitoring B-type natriuretic peptide levels for predicting rejection in heart transplant patients. She stated that all patients with levels >700pg/ml were rejecting. She stated that BNP levels cannot distinguish between acute rejection and chronic graft failure or allograft vasculopathy. She suggested that the results from her study could help to avoid unnecessary hospital admissions for patients suspected of re-

jection. The second fellows' talk was by Dr. Rabih Hamzeh (UCSD). Dr. Hamzeh described a new technique that has been developed to obtain percutaneous vascular access for catheterization when a standard approach is unsuccessful. The technique is a modification of the Seldinger technique and is performed using a targeting wire under fluoroscopy. He stated that this technique was successful in all 14 patients in which standard techniques for obtaining access were unsuccessful, and that there were no significant complications.

The final day of the conference consisted of a single session entitled Cardiac Cath Intervention and the Future. The first talk was by Dr. Robert Boucek (U. of Washington). Dr. Boucek stated that there is the need for cardiac myocyte regeneration in the pediatric population, as exemplified by a patient with



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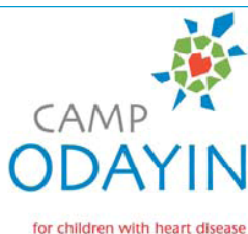


*Dr. Jacqueline Szmuszkovicz's lecture.*



*Drs. Carl Owada, William Evans and Jane Sommerville (left to right)*

HLHS who has a failing systemic right ventricle. He cited one of the greatest challenges in the stem field is to determine what is the best population of stem cells to be used for transplantation. He described several studies in adults in which bone marrow-derived stem cells are being transplanted into patients who have suffered myocardial infarction. In some cases, this seems to result in an increase in left ventricular systolic function. Although these kinds of studies raise great hope for the pediatric population, many obstacles remain



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(such as determining which stem cell population is optimal, and how to deliver them to the proper location and achieve long-lasting results). The next presentation was by Dr. William Berman (New Mexico) on future cardiac catheterization procedures. Dr. Berman described the numerous challenges for improving palliative catheterization procedures, including the development of stents that are bioabsorbable, sequentially expandable, have decreased risk of restenosis, can be used for maintaining patency of the ductus arteriosus, and for creating systemic to pulmonary shunts. He also discussed the development of a hybrid procedure for the bidirectional Glenn, VSD closure devices, and the need for new and better valves that can be delivered through catheter techniques into the right ventricular outflow tract. The next talk was by Dr. Carl Owada (UCSD), on when to resort to surgery for atrial septal defects. He reiterated the importance of having sufficient rim tissue as a requirement for performing device closure of ASDs. He recommended that most ASDs that have a minimum of 5-7mm of rim tissue in all dimensions should be amenable to device closure. If the dimensions of the rim tissue are uncertain, then a TEE should be performed to determine anatomic suitability. If there is insufficient rim tissue, then the patient should be referred for surgical closure. If the total septal length is less than the left atrial disc diameter, these patients should be referred for surgery. In his experience, eight of 180 patients with ASDs were referred for surgical closure. The remainder were closed by catheter techniques. The last lecture was by Dr. David Sahn (Oregon Health and Sciences U.), who gave an in depth discussion on new echocardiographic and MRI techniques that are being developed. He discussed how measurement of wall

strain is a much more accurate predictor of diastolic dysfunction than tissue Doppler. He also discussed how intracardiac imaging can facilitate performing ablations in the EP laboratory. Finally, Dr. Sahn discussed how new kinds of transducers, using matrix arrays, should improve our current imaging capabilities. Real time 3D echocardiography will bring about a paradigm shift and bring major improvements in qualitative and quantitative diagnosis to echocardiography.

To summarize, this year's conference was a smashing success. The diversity of the talks is a testimony to the growing complexity of pediatric cardiology and the ever-expanding fund of knowledge. Clearly, the best pediatric cardiology programs must incorporate this rapidly evolving knowledge from all aspects of pediatric cardiology in order to optimize patient care. Conferences like this year's WSOPC are a valuable tool for helping to convey the newest advances in pediatric cardiology. Next year's conference is tentatively scheduled to take place in Northern California.

~CCT~

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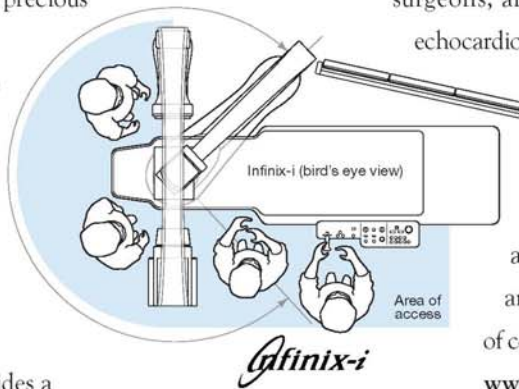


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