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Spontaneous Intermittent Closure of Patent Ductus Arteriosus in a Three-Year-Old Child: Angiographic Documentation

By Manoj Kumar Rohit, MD; Pushpendra Kumar Garg, MD, DM; Nand Kumar, MD; and Anju Gupta, MD

Introduction

Delayed closure of patent ductus arteriosus (PDA) is well described in preterm infants and less commonly in term infants. Intermittent closure due to spasm and subsequent patency of PDA has been described in term neonates, but is rare in older children. We described a three-year-old child with PDA

who developed transient complete closure noticed during catheterization which re-opened spontaneously after a few minutes.

Case Report

A three-year-old full-term born girl was presented to us with a history of recurrent respiratory tract infections since birth. On examination, she had a continuous murmur in the



Figure 1. Lateral view showed no flow across PDA.

“This case demonstrates that ductal spasm occur spontaneously and emphasizes the importance of prior good echocardiographic assessment of the PDA for proper sizing of the ductus.”

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Table 1: Oximetry Data

Site	Oxygen saturation (PDA spasm) %	Oxygen saturation (PDA open) 0%
SVC	67.1	65.3
RA	68	65.6
RV	67.3	65.8
LPA	67.4	79.2
AORTA	95.0	96.0

SVC=superior vena cava, RA=right atrium, RV=right ventricle, LPA=left pulmonary artery

Table 2: Pressure Data

Site	Pressure (PDA spasm) mm Hg	Pressure (PDA open) mm Hg
LPA	16/3/9	50/25/30
RV	25	50/25/30
RA	4/3/4	4/3/4
LV	108	120
AORTA	110/69/88	120/45/88

SVC=superior vena cava, RA=right atrium, RV=right ventricle, LPA=left pulmonary artery

left second intercostals space. Echocardiography revealed a 5 mm PDA with left to right shunt. She was taken up for device closure of PDA. During cardiac catheterization, aortic angiogram showed ampulla of PDA which was completely closed with no flow in pulmonary arteries. (Figure 1, Tables 1 and 2). Pressure data and oximetry studies at this point revealed no shunt. On auscultation, the continuous murmur also disappeared. As PDA was documented on echocardiography before catheterization, repeat angiogram was done after 30 minutes, which showed a trickle flow of dye into the pulmonary artery through the PDA (Figure 2). An angiogram repeated at 45 minutes showed 5 mm PDA (Figure 3). Mean pulmonary artery pressure was 30 mmHg and mean aortic pressure was 88 mmHg. A step-up of 15% was noted from right ventricle to pulmonary artery (Tables 1

and 2). A 10×8 mm Amplatzer PDA occluder device was deployed successfully without any residual flow. Follow up echocardiograph showed complete closure of PDA (Figure 4).

Discussion

Several factors affecting the closure of PDA have been elucidated over the years. The partial pressure of oxygen (PO₂), acid base status and responsiveness of pre-capillary pulmonary arterioles regulate pulmonary vascular resistance and hence, the degree of shunting and closure of duct. Catecholamine, bradykinin and acetylcholine have been also shown to affect ductal constriction. Intermittent closure of the ductus due to neurohormonal factors has been described in the neonatal period and, in pre-term in-

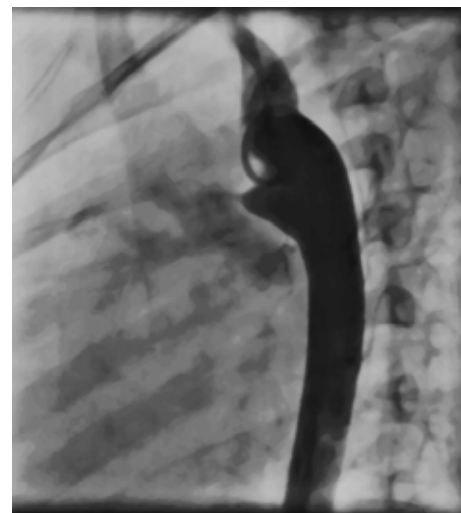


Figure 2. Lateral view showed trickling of flow across PDA with opacification of pulmonary arteries.



Figure 3. Lateral view showed crossing of wire from pulmonary artery to aorta through PDA.

fants with Respiratory Distress Syndrome, being managed on ventilator[1].

The concept of intermittent closure has however been questioned by some authors[2]. Angiographic and echocardiographic studies have shown and that once a ductus closes spontaneously

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Figure 4. PDA occluder device insitu.

it almost invariably stays closed. The “winking ductus,” which opens and closes, is most unusual though it can occur rarely in the cases of extreme prematurity (less than 25 weeks or under 700 gms) following pharmacological ductal closure. Such a phenomenon in older children is exceeding rare, and described in a very few case reports in literature[3].

Partial spasm of the ductus has been reported in literature due to catheter manipulation or only after the coil used to occlude the duct. Partial ductal spasm has lead to under estimation of size of the PDA, and resulted in embolization of the device or coil on subsequent days[4-5].

However, unlike previous reports of partial closure, our patient had total closure of the duct demonstrated angiographically by oximetry and by hemodynamic studies. We cannot rule out the accidental unnoticed touching of catheter with ampulla of PDA.

This case demonstrates that ductal spasm may occur spontaneously and emphasizes the importance of prior good echocardiographic assessment of the PDA for proper sizing of the ductus. Ductal spasm should be carefully excluded when angiographic size and echocardiographic measurement do not correlate.

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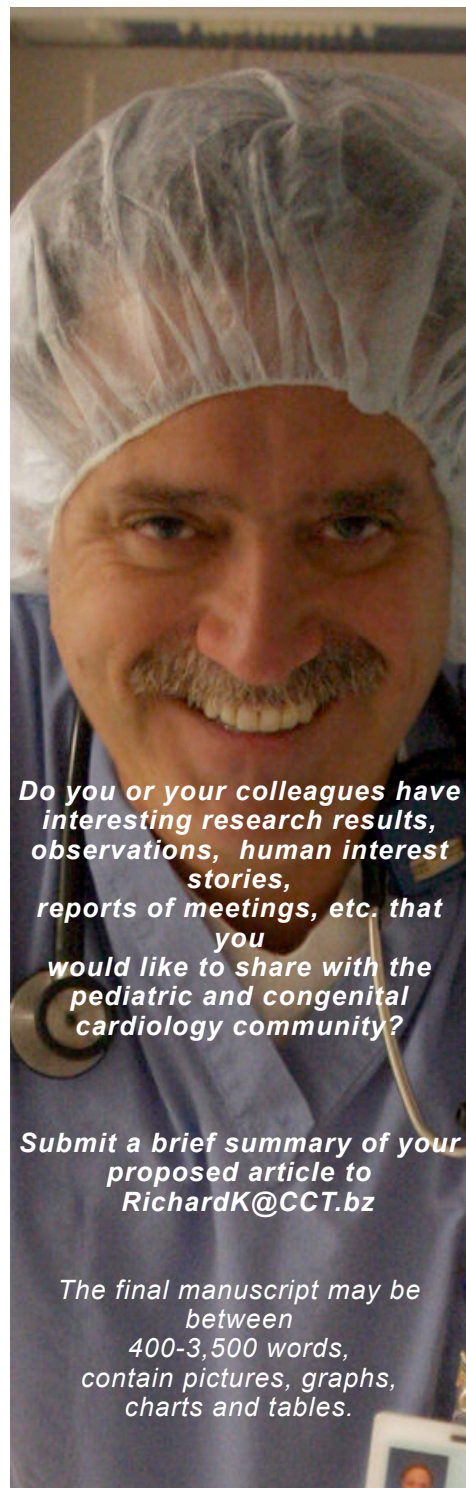
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Highlights from the 17th Utah Conference on Congenital Cardiovascular Disease, February 24-27, 2008

By Collin Cowley, MD

The 17th Utah Conference on Congenital Cardiovascular Disease took place in the mountains of Snowbird, Utah from February 24th -27th, 2008. This year's meeting celebrated the collaborative efforts of a world-class faculty in the incredible mountain setting where the year's cumulative snowfall has been 45 feet!

First held in 1980, this year's meeting covered a broad spectrum of topics presented by faculty from across the United States and Canada. Reflecting a departure from topics commonly considered at pediatric cardiology meetings, the session entitled "Oh My Heck! What Are We Doing?" examined some of the difficulties faced by patients, families, and clinicians when dealing with complex congenital heart disease. Dr Brian McCrindle (University of Toronto) opened the session by explaining how little we actually know about short and long-term outcomes for this heterogeneous group of patients. Dr McCrindle discussed many of the obstacles that continue to hinder our understanding of the broader implications of our treatment decisions early in life for patients requiring palliative procedures to allow survival. Dr Jeffrey Botkin (University of Utah) examined the ethical issues surrounding the early discussion of treatment options and the impact that practitioner's personal beliefs have on how options are presented. Dr Kate Faulkner (Tufts University) presented the option of palliative or comfort care for patients with life threatening disease requiring near-heroic treatment attempts. And finally, rounding out this session, Dr William McDonnell (University of Utah) presented an overview of some of the forces

impacting the current crisis in health care costs.

Among more conventional topics, Dr Tom Graham (Vanderbilt University) presented an historical overview of modern day pediatric cardiology and congenital cardiac surgery. Surgeons William Williams (University of Toronto), John Hawkins (University of Utah), James Tweddell (Medical College of Wisconsin), Peter Kouretas (University of Utah), and Thomas Yeh (Tulane University) collaborated in presenting the state of the art of many aspects of surgery for congenital cardiovascular disease. Doctors David Nykanen (Arnold Palmer Medical Center, Orlando, FL), Mark Galantowicz (Ohio State University), Shelley Miyamoto (University of Colorado), and Robert Gray (University of Utah) presented topics related to the role of diagnostic and interventional cardiac catheterization. University of Utah physicians Elizabeth Saarel, Angela Yetman, Lloyd Tani, Hassan Yaish, and Melanie Everitt presented data and made recommendations related to a number of common problems encountered in pediatric cardiology.

A chronologic perspective on congenital heart disease was initiated by Dr Jason Su (University of Utah) who presented insight into the impact of fetal detection of congenital heart disease. Dr Jack Rychik (University of Pennsylvania) presented the pioneering work in fetal intervention being performed at the Children's Hospital of Philadelphia. Dr Kirtly Parker-Jones (University of Utah) gave an entertaining presentation on contraception in adolescents and adults with congenital heart disease, stressing the importance of prevention, especially among an increasingly sexually active adolescent population. Dr Craig Broberg (University of

Oregon) was the final speaker of the meeting who provided sobering insights into the long-term ramifications of interventions undertaken earlier in life and the diverse personal and social challenges that many of these patients face during adulthood.

A highlight of the meeting every year, the Gore Cup ski race was again well attended with skiers and snowboarders of all ages working their way through the dual giant slalom course. Dr Mark Galantowicz, Co-Director of Nationwide Children's Heart Center in Columbus, Ohio demonstrated his prowess with the fastest time on the course. In comparison, Dr William Williams, Emeritus Professor of Surgery, University of Toronto, earned recognition for the most spectacular fall during the competition.

Scheduled for February 21 – 24, 2010, the 18th Utah Conference on Congenital Cardiovascular Disease promises to be another excellent opportunity to hear from a superb faculty about a variety of topics related to pediatric cardiology. The meeting is always structured to allow attendees time to ski or take advantage of a myriad of opportunities unique to the Mountain West. We hope to see you in 2010.

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Figures 1-3: Dr William Williams, Professor Emeritus, University of Toronto, and many time faculty member of the Utah Conference on Congenital Cardiovascular Disease, demonstrates his "winning" form during the Gore Cup Ski Race.

Inter-professional Congenital Cardiothoracic Education: Internationalising the Curriculum

By Kerry Cook, RGN, RN (Child),
BA(Hons), ENB 160, MSC(ANP) and
Imran Ali, Learning Technologist

In September 2006 the first cohort of the Post Graduate Certificate in Paediatric Cardiothoracic Care commenced with 12 students from around the United Kingdom and Southern Ireland. This cohort represented the views and experiences of national paediatric cardiac units; however, with two students working in Southern Ireland, an additional dimension was added, aiding further critical analysis of professional policies, procedures and strategies that underpin care delivery.

The first cohort had the unfortunate task of being the guinea pigs for a new programme, which was not without its teething problems. Administrative, technical and logistical issues arose, from which we have learned new strategies to improve the experience for future students. The most important factor identified was that in order for students to find the course successful and stress-free, comprehensive IT skills are essential for enabling them to get the most out of the e-resources available (Cook & Ali, 2007).

During the creation stage of the course some international networking took place; however, the global possibilities for marketing the course are being realised as the realms of e-technologies expand. Internationalisation of such an educational programme not only meets the progressive strategies of the university and academia, but accompanies the nature of advancing clinical practice. Health care professionals are continually learning with and from their colleagues internationally, about their practice and skills in an attempt to share "best practice" and, therefore, enhance the health care experience of the child, young person and their family. The sheer complexity of the specialism means that there is a 'limited' pool of individuals internationally that possess the relevant skills and knowledge to meet the needs of the service and the children, young people and their families.

Sharing of information, skills and knowledge globally is, therefore, an extremely important aspect of ensuring that care is up-to-date and evidence-based. It is also essential that the course reflects changes



Figure 1. Second-generation technology - Access to the Experts' lectures - www.cardiacmorphology.com

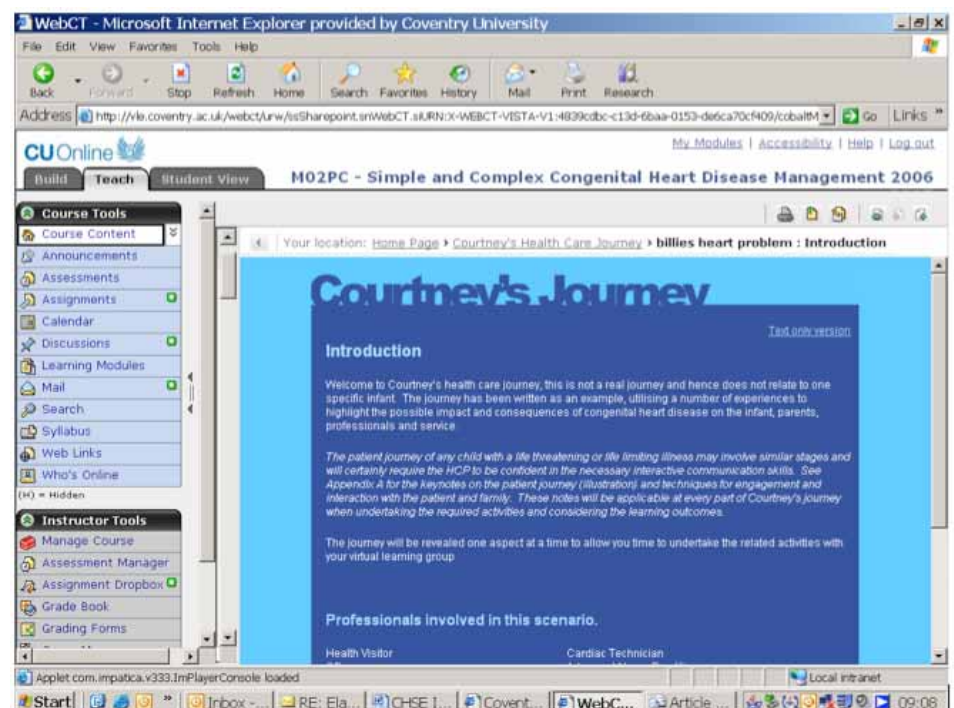


Figure 2. Fourth-generation technology - virtual patient journeys (from CUOnline, www.coventry.ac.uk)

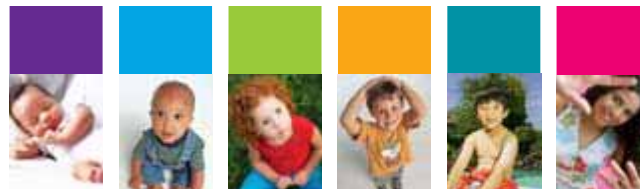
in service provision and delivery. E-learning is a beneficial medium to exchange, discuss and critique information and practice. Advances in computer technology and the availability of e-resources have enabled improved accessibility to specialist courses, allowing internationalisation to occur more readily.

Delivery, of the course, is entirely online, utilising various generations of technology (Dirckinck-Holmfeld, 2002) and styles of learning object to deliver relevant material to the students. The course is further enriched by: access to online video clips of teaching sessions delivered by clinical experts in the field, by the British Congenital Cardiac Association (BCCA), (that may be based within the UK, or elsewhere in the world (www.cardiacmorphology.com)) and by the inclusion and exploration of real patient journeys. International elements are embedded in the content of this learning material, with the long-term plan being to include more worldwide case studies. This online information will enable inter-professional students to learn with from, and about, each other (CAIPE, 1997), whilst broadening their knowledge and understanding, and incorporating an international component in their evidence-based practice. Online courses promote the use and practice of enhanced medical and surgical techniques that will ultimately benefit the care received by the child and young person.

However, despite the ease with which courses can be offered globally, certain limitations pose restrictions and potential hurdles for the module team to overcome if the venture is to be successful. Delivering lectures via web conference is an innovative way of ensuring synchronicity during live, face-to-face dialect.

Our experience of using web conferencing indicates that both speakers and learners require comprehensive inductions in order to increase their chances of participating in a rewarding web conference. This includes setting up their computers with the aid of a Learning Technologist and being aware of connectivity problems that may arise. Both speaker and learner are vulnerable to loss of Internet connectivity; it is therefore essential that users have a broadband connection. The East-West Coast (USA) 'switch-on' also affects the speed of internet connections and, therefore, web conferences need to be scheduled to avoid busy hours.

Although collaboration tools, such as web conferencing, can provide media rich learning experiences other factors need to be considered before deciding to use this conferencing tool. As this course begins to recruit internationally, language fluency of all involved will need to be considered. Web-conferencing requires a greater degree of language fluency as opposed to when using discussion forums, which allow for more time to understand and compose messages. Also, audio quality in a web conference can increase the difficulty in understanding accents. Students can, however, interact during the web conference using a chat tool, where questions or messages are typed for others in the conference to see. A certain level and speed of typing skills are however required to take part in the spontaneous chat that may occur using the chat screen (Horton 2006).



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“As technology improves, strategies for material delivery will become more innovative, resulting in greater accessibility for professionals, whilst reducing the distance barriers.”

Time zones may cause problems in terms of the ability for all students to log on at set times to attend web conferences, this could be seen to disadvantage some students but with the commencement of an international course there will be a review of working practices for the module delivery team taking the impact of time zones into consideration. E-learning is asynchronous (Salmon, 2004) to some extent, as students log on at different times and days of the week according to their personal and professional schedules. Including international students may increase the asynchronicity and the time span that postings to discussion forums are made to cover the 24-hour clock. E-facilitators will therefore, need to log on at varying times to capture the essence, and to facilitate the direction of discussions taking place.

The more difficult logistical aspects of including international students are compensated by the extremely positive aspects of learning from an international and inter-professional peer group, who will challenge the juxtaposition of discussions taking place to create a more questioning environment in which the students will learn.

Students will not only learn about different techniques and practices being implemented and employed around the world, but will glean an insight into the

varying nature of health care practitioner (HCP) roles; enabling critical analysis of their own experience and challenging traditional views. It is therefore, imperative that the content of the module reflects the international focus, including patient journeys from countries other than the UK. Bringing together a group of like-minded professionals from around the globe will forge stronger bonds and may even encourage movement and greater employability of HCPs internationally.

Internationalisation using new technologies enables us to 'reach out to new markets' (Deepwell, 2007) to provide specialist educational opportunities to all health care practitioners, whilst having a highly constructive impact on forging stronger relationships. As technology improves, strategies for material delivery will become more innovative, resulting in greater accessibility for professionals, whilst reducing the distance barriers. Inter-professional learning on an international scale will assist in the implementation of evidence-based care, encourage open forum discussions with international colleagues and ultimately have a positive impact on the experience of the child and their family.

For further details about the course, please contact Kerry Cook, Course Director kerry.cook@coventry.ac.uk

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Noncompaction of the Ventricular Myocardium and Mitral Valve Regurgitation: a Unique Association

By Sulafa KM Ali, MD, FACC, FRCPCH

Introduction

Noncompaction of the ventricular myocardium (NCVM) is a cardiomyopathy characterized by excessive myocardial trabeculations and deep inter-trabecular recesses. It can either be isolated or associated with congenital heart defects[1]. In a previous report we described a unique association of NCVM with mitral valve pathology in the form of valve leaflet deformity and mitral regurgitation (MR) in four patients[2]. In this report, we describe the same abnormalities in three other patients.

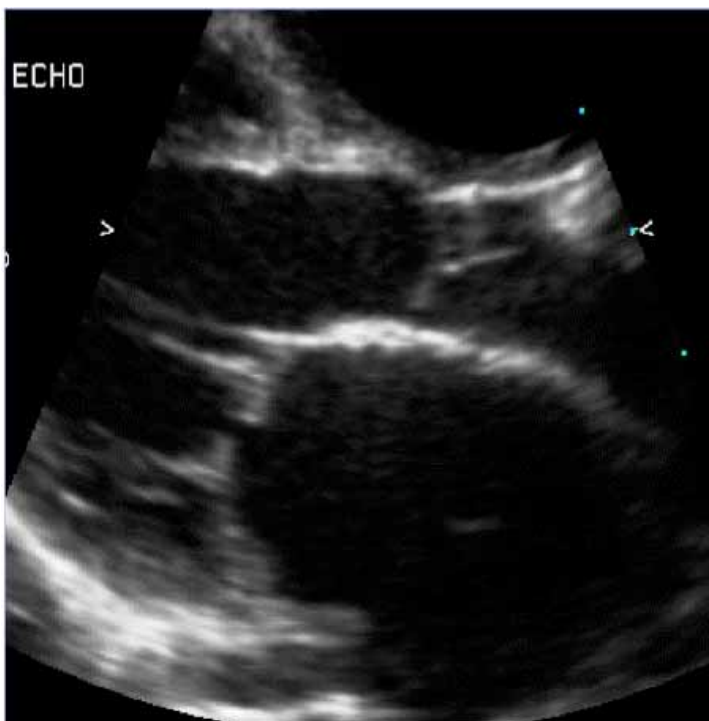


Figure 1. Parasternal long axis view showing anterior mitral valve leaflet coapting superior to the posterior leaflet with lack of complete coaptation.



Figure 2. Short axis view of the left ventricle distal to papillary muscles showing 2 layer appearance and noncompaction of the left ventricle myocardium.

“In conclusion, we think that there is a definite association between NCVM and mitral valve pathology that can lead to significant MR. This disease is more common in females.”

Patients and Methods

The patients were seen at the Sudan Heart Centre from July 2004-July 2007. Clinical and echocardiographic examinations

CURRENT TOPICS IN *Patent Ductus Arteriosus*
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Table 1: Patient Characteristics

No	Age	Sex	Clinical Features	Echocardiographic Features	Follow-up
1	18 month	Female	Heart failure (NYHA IV)	Mitral valve anterior leaflet coapts superior to the posterior leaflet (Figure 1). On the para sternal long axis view. On the 4 chamber view there is a zig-zag deformity of the anterior leaflet. There is Severe MR. Left Ventricle is dilated to 5.6 cm, NCVM seen apically (Figure 2). Ejection fraction is 62%.	F/U for 12 months. No change.
2	12 year	Female	Heart failure (NYHA II)	Mitral valve anterior leaflet coapts superior to the posterior leaflet. (Figure 3). Moderate degree of MR. NCVM seen at the left ventricle apex. Left ventricle is dilated to 5.8 cm. Ejection fraction is 65%.	F/U for 6 months. No change.
3	8 year	Female	Heart failure (NYHA II)	There is hypertrophic cardiomyopathy: interventricular septum is 2 cm and left ventricle posterior wall 1 cm. There is a gradient of 40 mmHg at the left ventricle outflow. Ejection fraction is 80%. Mitral valve anterior leaflet coapts superior to the posterior leaflet with moderate MR. NCVM is seen at the left ventricle apex. There is a vegetation measuring 10X10 mm tethered to the anterior mitral leaflet.	F/U for 6 weeks. No change.

were done. Noncompaction was diagnosed with the following criteria:

1. From the parasternal short axis view distal to papillary muscles the noncompacted layer thickness is measured at the end of systole and compared to the compacted layer thickness. A ratio of > 2:1 is considered significant.
2. A 2-layer appearance of the myocardium from different views.
3. Demonstration of the inter trabecular recesses using low scale color flow.
4. Follow-up was arranged for every 2-6 months.

Results

Patient's characteristics are shown in Table 1.

Discussion

NCVM is being increasingly recognized but its association with mitral valve deformity mimicking mitral valve prolapse is not well established. We first observed this association in four patients [2]. In the previous as well as current patients females predominated (female to male ratio 6:1). All patients showed the same mitral valve deformity in the form of abnormal coaptation in the long axis view, and a unique zigzag deformity in the apical Four chamber view. All patients showed a normal ejection fraction therefore MR cannot be secondary to myocardial dysfunction. The degree of MR is variable from

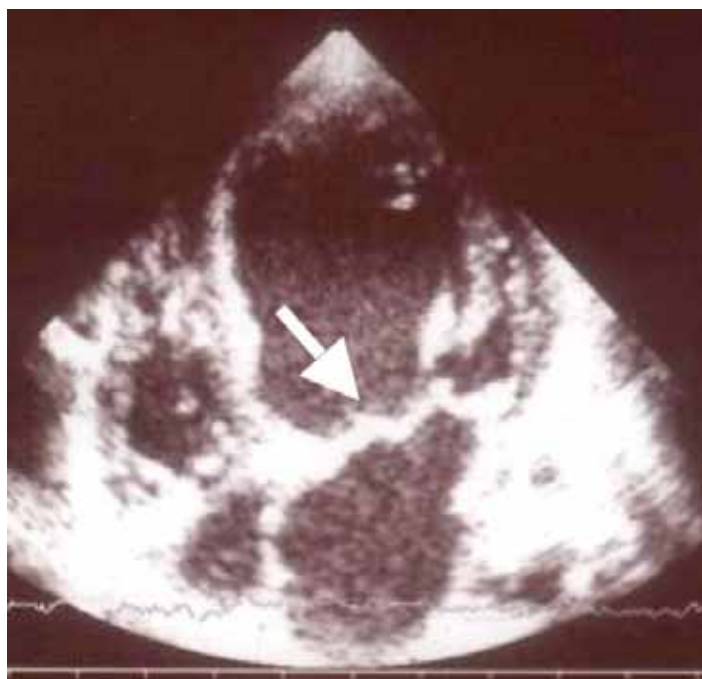


Figure 3. Four chamber view showing zigzag deformity of the anterior mitral leaflet (arrow).



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moderate to severe. In patient number 3, there were two important associations: hypertrophic obstructive cardiomyopathy (HOCM) and infective endocarditis. Hypertrophic cardiomyopathy had been reported to be associated with NCVM by us and also by others [1,3], but without obstruction. Endocarditis is a known complication of abnormal mitral valve. There are important implications of NCVM on the surgical management of patients with MR as NCVM can be associated with myocardial dysfunction, arrhythmias, embolic events and a poor prognosis in adults[4].

In conclusion, we think that there is a definite association between NCVM and mitral valve pathology that can lead to significant MR. This disease is more common in females.

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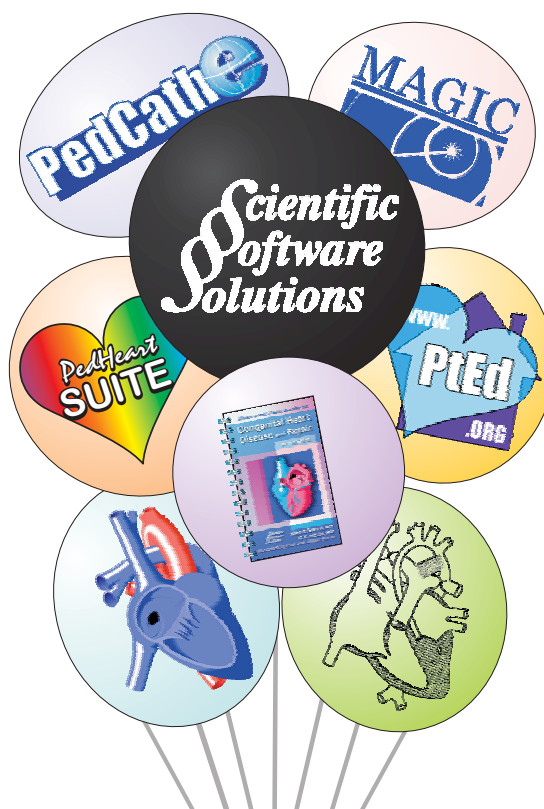
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Medical News, Products and Information

"Congenital Heart Disease: Cardiac Morphology & Echocardiography – A Multimedia Presentation" by S. Yen Ho and William C.L. Yip

This is a newly produced DVD (ISBN 978-981-05-7231-0) that encapsulates a multimedia book by combining movie clips of morphology demonstrations and echocardiograms, text slides, and diagrams. It begins with normal anatomy and the sequential segmental analysis of malformed hearts, followed by chapters on the more common forms of heart defects. Each chapter has a morphology review followed by echocardiograms of the lesions. Emphasis is given to delineation of anatomy by real-time cross-sectional imaging and colour-flow mapping.

Why a DVD ?

1. Echocardiography is an imaging technique that is very widely used in diagnosing structural malformations of the heart. There are several textbooks available on this subject. However, in practical terms, doctors see moving images of echocardiograms on screens to make their diagnosis. Still images of echocardiograms as presented in conventional textbooks often are inadequate for proper understanding. There are only a few DVD titles available that have echo movies, but there are none with morphological correlates presented in a systematic fashion to help understand the heart structures that are displayed on echocardiography.
2. For better understanding of congenital heart malformations, a 3D perspective is crucial. Again, while there are a few textbooks on cardiac anatomy they are inadequate when it comes to visualizing the heart in 3D.
3. This DVD will be a very useful tool for self-learning by junior doctors wishing to specialize in congenital heart disease, and also for experienced doctors who may not see many patients with congenital heart disease, but wish to refresh their knowledge.

Yen Ho is a well-recognised cardiac morphologist with a long and vast experience in education especially in correlating cardiac morphology with imaging modalities such as echocardiography. She heads the Cardiac Morphology unit at the Royal Brompton Hospital, London, UK. William C.L. Yip is well known internationally as a very experienced Paediatric Cardiologist and Interventionist. Based in Singapore, he has conducted many training programs for Paediatric Cardiologists especially in the Far East and Asia-Pacific region.

Send enquiries to: Morphology@rbht.nhs.uk

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Study will look at German-made heart pump for children needing heart transplants

Texas Children's Hospital has been named the national lead center for a 12-hospital, 36-month clinical trial of the German-manufactured pediatric heart pump called Berlin Heart EXCOR® Pediatric Ventricular Assist Device (VAD).

Charles D. Fraser, Jr., MD, chief of pediatric and congenital heart surgery at Texas Children's and professor, Michael E. DeBakey Department of Surgery at Baylor College of Medicine, will serve as the National Principal Investigator for the Investigational Device Exemption prospective study. As NPI, Fraser will work in cooperation with 10 U. S. hospitals and two Canadian hospitals, in collecting and reporting data to the United States Food and Drug Administration on the safety and probable benefit of the pediatric heart pump. At the study's conclusion, Berlin Heart, Inc. will present those data to the FDA for consideration of approval of the EXCOR Pediatric VAD for use in the U.S.

"The Berlin Heart holds a lot of promise for infants and children whose hearts are failing," said Fraser. "It's extremely gratifying to be part of such a collaborative study involving the FDA and the other leading heart centers around the nation in exchanging information that will ultimately benefit many pediatric heart patients."

The Berlin Heart EXCOR Pediatric VAD, which comes in graduated sizes to fit a pediatric population from newborns to teens, is the only pediatric heart pump that provides medium-to-long-term mechanical circulatory support for infants and children awaiting heart transplantations. The device has been approved in Germany and Europe since 1992, but does not have FDA approval for use in the U. S.

"The Berlin Heart is especially attractive as an option for circulatory support in babies and small children awaiting heart transplantation," said Fraser. A particular advantage is that children can get up, walk around and be kids again while they are recovering and waiting for a donor heart."

Along with Texas Children's Hospital, 11 hospitals will participate in the study: Arkansas Children's Hospital, Little Rock; Boston Children's Hospital; Children's Hospital of Wisconsin in Milwaukee; Riley

Children's Hospital, Indianapolis; Mott Children Hospital, Ann Arbor; Lucille Packard Children's at Stanford; St. Louis Children's Hospital; Seattle Children's Hospital; and Children's Hospital at the University of Alabama at Birmingham. Stollery Children's Hospital in Edmonton, and the Hospital for Sick Kids in Toronto are participating in Canada.

In addition to the IDE study, Texas Children's Heart Center has been named the first Berlin Heart Reference and Training Center in the United States – offering support to hospitals not participating in the study who seek to use the Berlin Heart for the first time. Dr. David Morales, pediatric cardiovascular surgeon at Texas Children's and assistant professor, Michael E. DeBakey Department of Surgery at Baylor College of Medicine, will direct a training team comprised of cardiac surgeons, cardiologists, perfusionists, operating room nurses, ICU nurses, research nurses and a designated Berlin Heart Fellow. The team will hold periodic training sessions at Texas Children's, and they will also travel to other hospitals to provide instruction on-site.

"We are delighted to have the experienced and dedicated team from Texas Children's Heart Center as our first Reference and Training Center in the U.S.," said Robert H. Halfmann, MD, director clinical science at Berlin Heart GmbH, Germany. "We are also pleased to work with Dr. Fraser as the NPI for the EXCOR Pediatric IDE trial, which is of great importance to us."

Between 2000 and 2007, prior to FDA approval to begin the study, pediatric hospitals in the U. S. used the Berlin Heart under the FDA's emergency or "compassionate use" regulations. Each time a physician wanted to implant the Berlin Heart in a child dying of heart failure, a special appeal had to be made to the FDA for approval on a case-by-case basis. If approved, the Berlin Heart had to be flown from Germany while the child waited, possibly losing precious time. Also, under prior FDA regulations, the device could not be stored in the U.S., but had to be flown back to Germany if it was not used. Now with the IDE study in place, participating centers may keep the device on hand for easier access for their patients with failing hearts.

For more information visit www.texaschildrens.org

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WATCH LIVE CASES ON THE WEB

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**Watch Live Cases from Milan, Italy; Columbus, OH, USA; Toronto, Canada,
performed by experts in the field:**

Perventricular Muscular VSD - Drs. Emile Bacha, Zihad M. Hijazi and Daniel Rowland,

Perventricular Membranous VSD - Drs. Hakan Akintuerk, Zihad Amin and Qi-Ling Cao

Hybrid Stage I Palliation for HLHS PA Bands and PDA Stent - Drs. Mark Galantowicz and John P. Cheatham

Intraoperative Aortic Stent for CoA - Drs. Redmond Burke and Evan Zhan

Intraoperative LPA Stent Using Endoscopic Guidance - Drs. Alistair Phillips, Ralf J. Holzer, and Vincent Olshove, CCP

Creation of ASD after PA Bands & PSA Stent for HLHS in a Preemie - Dr. John P. Cheatham, Sharon L. Hill, ACNP

Perventricular Implant of Edwards Valve Stent in the Pulmonary Position - Drs. Zihad M. Hijazi and Jinfen Lin

Closure of Septal Defect Using Real Time 3D Echo Guidance - Drs. Nikolay V. Vasilyev and Qi-Ling Cao

High Frequency Ultrasound Creation of ASD - Drs. Nikolay V. Vasilyev and Qi-Ling Cao

PmVSD Closure - Dr. Mario Carminati

Transcatheter Implantation of Implantable Melody Valve - Dr. John Cheatham

Percutaneous Closure of ASD(s) with TEE or ICE Guidance - Percutaneous Valve Implantation - Drs. Eric Horlick
and Lee Benson

Perimembranous VSD Closure with Amplatzer Membranous VSD Occluder - Drs. M. Carminati, J. Bass, G.F. Butera,
D. Hagler and M. Carrozza

New live cases will be added in the following months.



If you would like to be notified when additional live cases have been added, please send an email to: LiveCases@CHDVideo.com.
For more information on the symposiums that produced these live cases, and how to attend, please visit:

- **ISHAC** (International Symposium on the Hybrid Approach to Congenital Heart Disease) www.hybridsymposium.com
- **PICS-AICS** (Pediatric and Adult Interventional Cardiac Symposium) www.picsymposium.com
- **International Workshop IPC** (International Workshop on Interventional Pediatric Cardiology) www.workshopipc.com

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Cook Medical invites you to learn more about embolization therapies at PICS-AICS 2008 in Las Vegas at The Bellagio Hotel.

Sunday, July 20, 2008

Grand Ballroom

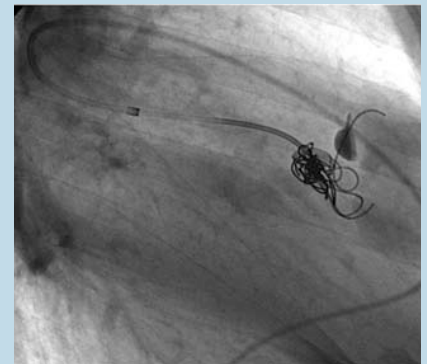
8:30-11:30 a.m.

Comprehensive Workshop: Embolization Therapy

Moderators: *John P. Cheatham, Seong-Ho Kim
and Shakeel Qureshi*

1. What Do You Need in the Cath Lab for Embolization Therapy?
- *Robert White*
2. Catheter Management of Pulmonary AVMs.
- *Robert White*
3. Aorto-Pulmonary Collaterals: Anatomy and Indications for Closure.
- *Lee Benson*
4. Aorto-Pulmonary Collaterals: Closure Techniques, Results.
- *Shakeel Qureshi*
5. Veno-Venous Collaterals Pre & Post Fontan: When and How to Close Them.
- *Jeffrey Feinstein*
6. Coronary Arteriovenous Fistulas: Anatomy, Closure and Results.
- *Jo de Giovanni*
7. Retrieval Techniques in the Cath Lab.
- *Omar Galal*

Transcatheter occlusion
of a large PAVM.



Radiographs provided by Dr. Robert I. White Jr.,
Yale University, Department of Vascular and
Interventional Radiology, New Haven, CT.