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Determining the Incidence of Sudden Cardiac Death in the Young: The Orange County Experience

By Anjan S. Batra, MD; Tiffany Cheng, MS3

Sudden Cardiac Death (SCD) among young athletes is a devastating tragedy that continues to occur. The sudden and unexpected death of such a young individual in apparently excellent physical fitness is a highly visible event that stimulates considerable concern among both the medical and lay communities. Though seemingly rare, media reports drawing attention to these events have raised the question of whether generalized screening of athletes should be implemented in the United States. This is because despite the best efforts by health care providers to identify the patients and families with cardiac conditions, pediatric sudden cardiac death still occurs.[1] However, due to the lack of a national registry, there exists no organized database for tracking these events. As a result, the actual incidence of SCD among the pediatric population in the United States remains unknown.

Epidemiology of SCD

So far there have been limited population based studies on SCD in children in the United States and Europe estimating the incidence between 1 and 5 per 100,000 person-years (Table 1). Note that this is per population and not per children in the population. The precise frequency with which SCD occurs in young athletes is not known. There are a number of practical obstacles to the collection of such data. Estimates that rely on reporting from individual schools and institutions, as well as on media accounts, probably underestimate the occurrence of these events. Most studies on the prevalence of SCD are retrospective and based upon death certificates. Such studies carry intrinsic bias and can be highly inaccurate. Also, the incidence of sudden cardiac arrest is clearly higher than that of SCD especially with the recent emphasis on CPR education and widespread availability of automatic external defibrillators.

The Orange County Experience

Here in Orange County, California, we have begun to address this issue by considering our unique location and population. Orange County has the largest number per capita of NCAA and Olympic athletes of any county in the United States. And with an estimated population of over

"Though seemingly rare, media reports drawing attention to these events have raised the question of whether generalized screening of athletes should be implemented in the United States."

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Table 1 - Epidemiology of SCD in The Young					
Report	**Publication Date**	**Dates Data Collected**	**Age Range**	**Event Rates**	**Method of Estimation**
Driscoll et al.[2]	1985	1950-1982	1 and 22 years	1.3 cases per 100,000 person years	Population-based study by review of death certificates
Chugh et al. [3]	2009	2002-2005	< 18 years	1.7 cases per 100,000 person years (90% <1 year)	Population-based study in Portland, Oregon by emergency room and medical examiner records
Maron et al.[4]	2009	1985-2007	High school and college athletes	0.93 deaths per 100,000 person-years	Registry and insurance records in Minnesota
Maron et al.[5]	2009	1980-2006	Athletes < 40 years	0.61/100 000 person-years	National registry for sudden deaths in US athletes
Corrado D et al. [6]	2006	1979-2004	12-35 years	Athletes: 1.9 deaths/100,000 person-years Non-Athletes: 0.79 deaths/100,000 person-years	Prospective cohort study in Veneto, Italy
Harmon et al. [7]	2011	2004-2008	NCAA Athletes	2.28 deaths per 100,000 person-years	NCAA Database, media reports, insurance claims

3 million, a quarter of which accounts for those under 18 years old, establishing the incidence of SCD in Orange County will be a step forward in determining the true scope of this problem.

To begin this process, we first determined how SCD events in Orange County can be tracked. Figure 1 shows a simplified layout of how the sequence of events can be captured following a SCD outside of the hospital. Before initiating the prospective data registry, we felt it was critical to evaluate the accuracy and ease of obtaining the data that was currently being collected by each of these entities. With this outline in mind, we requested currently existing databases from all 3 entities: the Emergency Medical Services (EMS) database, the Office of Statewide Health Planning & Development (OSHPD), and the Orange County Child Death Review Team (division of the Coroner's Office). From the EMS database, we should be able to examine all records related to "cardiac arrest," including paramedic's "on-scene" assessments. The OSHPD database includes Emergency Department and Inpatient hospital data for all hospitals in Orange County, which provides the details on all cases with principal diagnoses of "sudden cardiac arrest," "cardiac arrest," or "syncope & collapse" (ICD-9 codes of V12.53, 427.5, or 780.2). Finally, data from the coroner's office will give us a sense of how many sudden cardiac arrest events resulted in SCD. We requested data for the last 10 years from each entity for cases with individuals <35 years old.

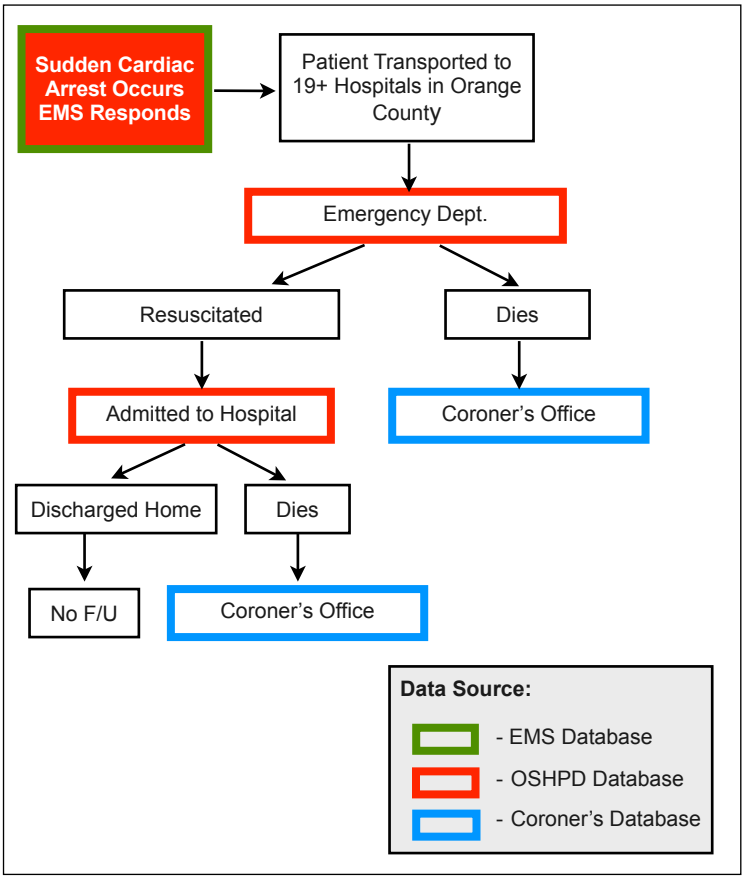

Figure 1. Diagram for tracking SCD events in Orange County.

Preliminary Data

Thus far, we have received preliminary data from the Orange County Coroner's office and OSHPD from 2001-2010 and are in the process of obtaining the data from the EMS. Data from the Orange County Coroner's office shows an incidence of 1.58 cases per 100,000 person-years, with pediatric cases of SCD accounting for 17.8% of all SCD events in those <35 years old. These cardiac-related deaths include cases of Sudden Infant Death Syndrome (SIDS), which was previously reported by the Oregon Sudden Unexpected Death study in 2009 to account for a large portion of the pediatric sudden deaths in their population.[3] Despite our population being about 4.5 times that of Multnomah County, Oregon, our preliminary results resemble the incidence rates previously published by the Oregon Study.

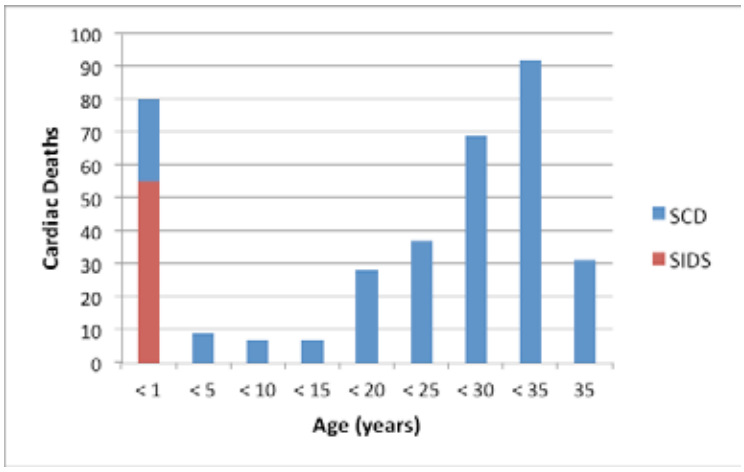

Figure 2. Age distribution of cardiac deaths in Orange County.

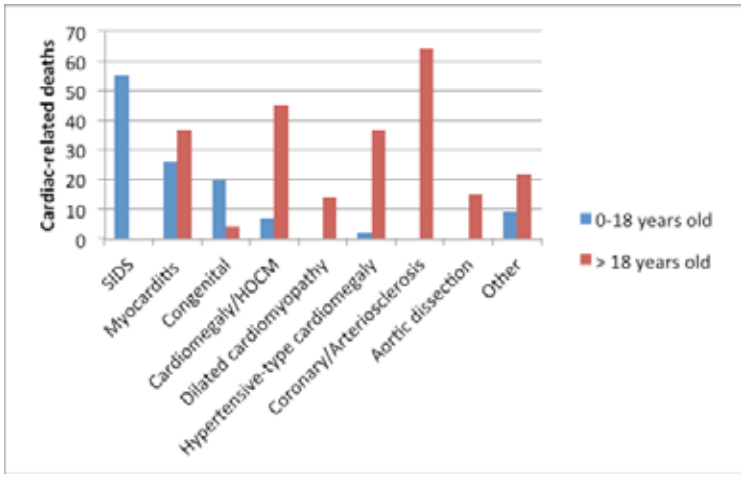

Figure 3. Causes of cardiac related deaths in Orange County.

Additionally, our preliminary data show that the age distribution of SCD events is bimodal (Figure 2). The large number of deaths occurring in children <1 years old is highly contributable to SIDS, while the gradual increase in events in the young adult age groups may be due to multiple causes. Since we could not identify whether these individuals were athletes or not, these SCD events could be related to increased athletic conditioning or advancing co-morbid conditions such as diabetes or atherosclerosis.

For the pediatric age group, the top three causes of cardiac death were SIDS, myocarditis, and congenital anomalies (Figure 3). Males were 2.5 times more affected than females, with white and Hispanic ethnic groups outweighing others.

Discussion

Our model for building a registry is similar to the one set forth by the Cardiac Arrest Registry to Enhance Survival (CARES)[8] first piloted in

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"Without a national registry to keep track of SCD events, we do not know exactly how many individuals are affected each year. Our hope is that by beginning in Orange County, we can start to establish a centralized repository for data on SCD and provide the medical community with a more concrete understanding of the incidence of these events."

Atlanta, Georgia by the CDC. In that study, data was also captured from the three sources comprising the continuum of emergency cardiac care: 911 dispatch, EMS providers, and receiving hospitals. The goal of this registry was to provide communities with a means to identify cases of out-of-hospital cardiac arrest, measure how well emergency medical services (EMS) perform key elements of cardiac care, and determine outcomes through hospital discharge. Developed as a central repository of data about cardiac arrests from EMS systems throughout the United States, CARES collects data from separate sources and links them to a single record. The dataset is extensive, including 911 response time, bystander CPR efforts, application of automated external defibrillator (AED) and whether shocks were delivered, hospital admission/course/discharge or death, and discharge neurological and cardiovascular status. CARES generates standard reports that can be used to characterize the local epidemiology of cardiac arrest and help managers determine how well EMS is delivering out-of-hospital cardiac arrest care. After pilot implementation in Atlanta and subsequent expansion to 7 surrounding counties, CARES was implemented in over 40 communities in 23 states.

We anticipate that the additional data we will analyze from EMS and OSHPD will allow us to further determine the true incidence of SCD in Orange County. Trying to form a link between each of these data sources is another one of our objectives. We hope to continue to learn from our current efforts in Orange County, to build a registry for SCD in the young, and ultimately to team up with other efforts such as the CARES registry to create one unified national registry.

Conclusion

The United States has 25 million competitive athletes involved in a network of sporting activities and 10 million high school and college athletes. Without a national registry to keep track of SCD events, we do not know exactly how many individuals are affected each year. Our hope is that by beginning in Orange County, we can start to establish a centralized repository for data on SCD and provide the medical community with a more concrete understanding of the incidence of these events. It will also build the foundation for future epidemiological studies on populations most at risk, common factors that predispose a child to SCD, and areas where prevention can be

targeted. This will allow us to better serve the youth of communities nationwide and become the launching pad for a better understanding and prevention of SCD.

There is an upcoming symposium on the current controversies surrounding sudden cardiac arrest in children & adolescents to be held at Disney's Grand Californian Hotel & Spa on Friday & Saturday, January 25-26, 2013. Keynote speakers will include: Dr. Barry Maron, Minneapolis Heart Institute Foundation and Frank Marcos, University of Arizona Health Sciences Center. This two-day conference will present current controversies on topics related to the diagnosis, therapy and prevention of cardiac arrest in children and adolescents. Deadline for early bird registration is December 17th, 2012.

Online Registration: www.choc.org/scaconference.

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Image of the Month #3 - December 2012 - Presented by The Archiving Working Group

Contributors: Vera D. Aiello, MD; Diane E. Spicer, BS; Jeffrey P. Jacobs, MD; Jorge M. Giroud, MD; Robert Anderson, MD

This is a special column that is published bimonthly in *Congenital Cardiology Today* with contributors and images from the *Archiving Working Group* (AWG) of *the International Society for Nomenclature of Paediatric and Congenital Heart Disease.*

Please visit us at the AWG Web Portal at http://ipccc-awg.net and help in the efforts of the *Archiving Working Group* and the *International Society for Nomenclature of Paediatric and Congenital Heart Disease*.

The authors would like to acknowledge the Children's Heart Foundation (www.childrensheartfoundation.org) for financial support of the AWG Web Portal.

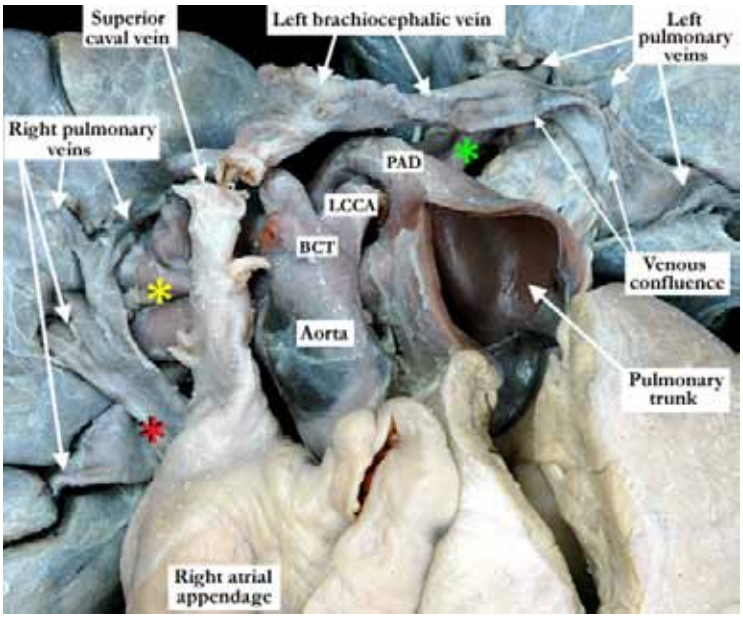


Figure 1. Description: The anterior anatomic view of this heart with concordant atrioventricular and ventriculo-arterial connections demonstrates normally related great arteries, and shows the left brachiocephalic vein draining to the superior caval vein. There is mixed totally anomalous pulmonary venous return, with the left pulmonary veins draining in supracardiac fashion to a venous confluence that then drains into the left brachiocephalic vein, while the right pulmonary veins (red asterisk) drain to the coronary sinus, and thence to the right atrium (see companion image) (yellow asterisk-right pulmonary artery, green asterisk-left pulmonary artery, BCT-brachiocephalic trunk, LCCA-left common carotid artery, PAD-patent arterial duct). Contributor: Diane E. Spicer, BS.

IPCCC: 4.08.30, 04.06.03, Q1.01.55, 04.06.12, Q1.01.52

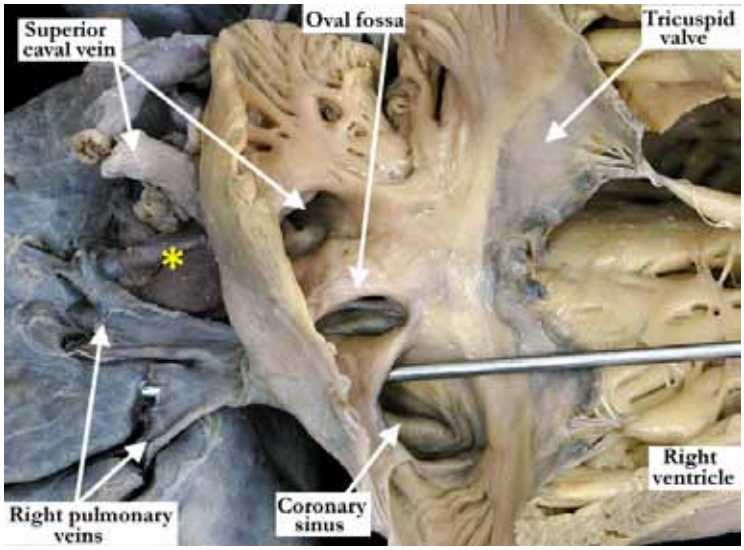


Figure 2. Description: The right atrium has been opened, and a probe inserted through the coronary sinus to reveal the anomalous drainage of the venous return from the right lung. The veins from the left lung drain in supracardiac fashion to the left brachiocephalic vein. As expected, the orifice of the coronary sinus is markedly dilated. There are concordant atrioventricular connections, with the tricuspid valve guarding the inlet to the right ventricle. The oval foramen is probe patent. The course of the left pulmonary veins can be viewed in the companion image. (yellow asterisk-right pulmonary artery). Contributor: Diane E. Spicer, BS.

AEPC Derived Term

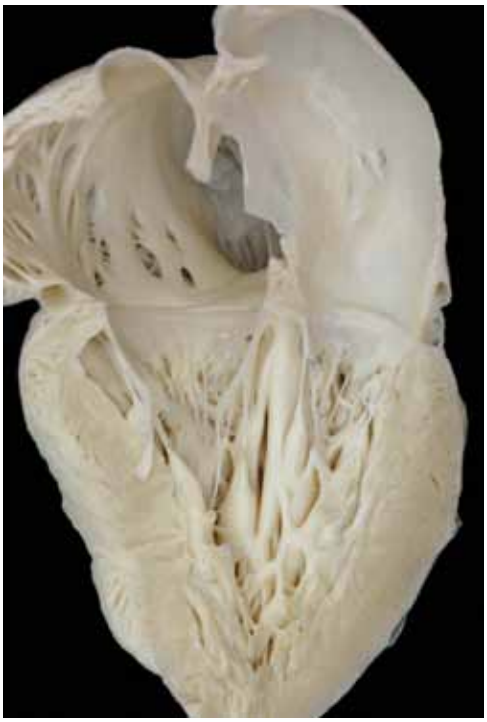
- Totally anomalous pulmonary venous connection: mixed (04.08.30).
- Supracardiac location of anomalous pulmonary venous connection(s) to left-sided vertical vein- left pulmonary vein(s) (04.06.03, Q1.01.55).
- Intracardiac location of anomalous pulmonary venous connection(s) to coronary sinus - right pulmonary vein(s) (04.06.12, Q1.01.52).

EACTS-STS Derived Term

- Total anomalous pulmonary venous connection (TAPVC), Type 4 (mixed) (04.08.30).
- Pulmonary venous connection anomalous, Supracardiac-modifier for site of drainage, Supracardiac location of APVC to left-sided vertical vein, Pulmonary veins-modifier for vein(s) involved, Left pulmonary veins (04.06.03, Q1.01.55).
- Pulmonary venous connection anomalous, Intracardiac-modifier for site of drainage, Intracardiac location of APVC to coronary sinus, Pulmonary veins-modifier for vein(s) involved, Right pulmonary veins (04.06.12, Q1.01.52).

ICD 10 Term: Total anomalous pulmonary venous connection (Q26.2).

AWG Web Portal link for this series of images:
http://ipccc-awg.net/TAPVC/TAPVC_Mixed_04_08_30/TAPVC_Mixed_04_08_30_SVC_CS.html



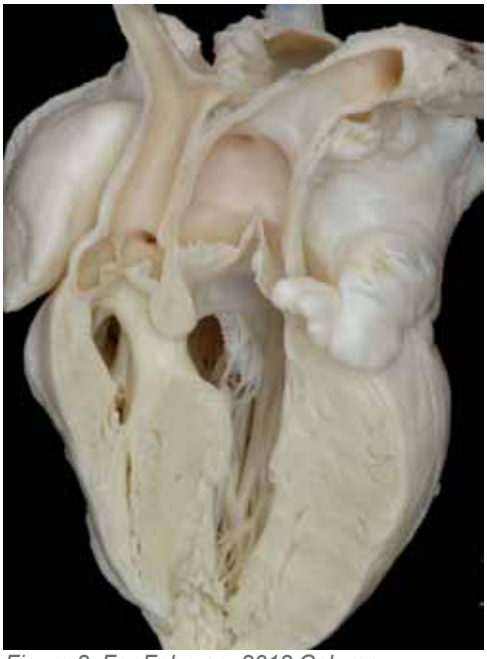


Figure 3. For February 2013 Column.

CCT

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Pleural Fluid Triglyceride Cholesterol Ratio in Chylothorax

By Sameh Ibrahim Sersar, MD

Presented at the *7th Congress of Update in Cardiology and Cardiovascular Surgery* in association with TCT Mediterranean which will be held on 24-27 March 2011, in Antalya, Turkey. Oral Presentation number: 0554.

Abstract published in *International Journal of Cardiology*, Vol. 147 (March 2011), S44. doi:10.1016/S0167-5273(11)70136-X.

Key Words

Chylothorax, Triglyceride Cholesterol Ratio, steroids, octreotide, fat-free diet, Monogen

Abstract

Introduction

Very little, if any, is discussed in the recent cardiothoracic surgery publications about Triglyceride Cholesterol Ratio value either in the diagnosis or the prognosis of Chylothorax.

Patients and Methods

A retrospective analysis of 60 patients with chylothorax with a mean age of 21 months (range, 1 month-65 years) who developed chylothorax after heart surgery (January 2007 through December 2010). Data were collected regarding demographics, method of diagnosis, surgical procedures, characteristics of chylous drainage and its management. The patients were divided into 3 groups: Group 1 (ratio <1); Group 2 (ratio between 1-2) and Group 3 (ratio >2).

Results

Eighteen cases had a ratio <1, 14 had a ratio between 1-2 and 28 had a ratio >2. There were 2 hospital mortalities; both had a triglyceride/cholesterol ratio >2. All patients responded to the conservative treatment, except two cases who required further thoracic duct ligation.

Conclusions

Pleural Fluid Triglyceride Cholesterol Ratio in Chylothorax can be used in the diagnosis of chylothorax, and more importantly, as a prognostic detector in cases of post cardiac surgery chylothorax.

Introduction

Very little if any is discussed in the recent cardiothoracic surgery publications about Triglyceride Cholesterol Ratio either in the diagnosis or the prognosis of Chylothorax. The incidence of chylothorax post cardiac surgery has increased from 0.6–1.5% up to 6.6% over the past 15 years. Diagnosis of chylothorax relies on the presence of chylomicrons, a triglyceride level above 1.1 mmol/L, and an absolute white blood cell count above 1,000 cells/mm3, with a lymphocyte fraction above 80% in the pleural fluid.[1-2-3-4-5]

Kerpsack SJ et.al., 1994 used the determination of the pleural fluid triglyceride cholesterol ratio of > 1 in the pleural fluid as one of their two criteria to diagnose chylothorax in cats. The other one was presence of chylomicrons.[6]

Soto-Martinez M and Massie J 2009; consider the presence of chylomicrons in the pleural fluid as the key diagnosis. Chylomicrons can be seen after staining with Sudan III which requires special cytological preparation of the pleural fluid that may not be freely available in each laboratory. Triglyceride concentration of the fluid is a simpler method but only positive if the concentration is above 1.1 mmol/L (concentrations between 0.56 and 1.1 mmol/L are equivocal). Administration of a high fat meal by mouth or via a nasogastric tube will result in a dramatic change in the colour, triglyceride and chylomicron content of the pleural effusion, confirming the presence of chyle leak.[7]

We aimed to investigate the value of triglyceride cholesterol ratio as a diagnostic and prognostic tool in patients with chylothorax.

Patients and Methods

This is a retrospective study of the files of 60 cases of post cardiac surgery chylothorax in one centre in Jeddah, KSA (between January 2007 through December 2010 in KFSH&RC; Jeddah). Approval to use the medical records of the patient was obtained from the section head. The inclusion criteria of the patients were one or more of the following criteria:

1. Pleural fluid triglyceride level above 1.1 mmol/L.
2. Pleural fluid absolute white blood cell counts above 1,000 cells/mm3.
3. Pleural fluid lymphocytes above 80%.
4. Presence of chylomicrons in the pleural fluid.

Data were collected regarding demographics, method of diagnosis, surgical procedures, characteristics of chylous drainage and its management. We calculated the pleural fluid triglyceride/cholesterol ratio in the chylothorax cases. The patients were then divided into three groups: Group 1 (ratio <1); Group 2 (ratio between 1-2) and Group 3 (ratio >2).

We tried to determine the value of pleural fluid triglyceride/cholesterol ratio in both the diagnosis and prognosis of those patients. Chylothorax is clinically suspected once the pleural fluid drainage is profuse, milky, prolonged or the trend of drainage is going up. Data were presented as mean or median with ranges or percentages as appropriate. Differences in categorical variables were analyzed by means of the χ^2 analysis, and differences in continuous variables were analyzed by Student t-tests. The Fisher Exact Test was also used where appropriate. Differences were considered to be statistically significant when p value was less than 0.05.

Results

Sixty cases diagnosed as chylothorax post cardiac surgery were included in our retrospective study. Fifty-nine had a repair or palliation of congenital heart diseases and one case had CABG. Females were more than males (34/26). Chylothorax was suspected if the chest tube drainage is excessive with milky colour with one or more of the following criteria:

1. Pleural fluid triglyceride level above 1.1mmol/L.
2. Pleural fluid absolute white blood cell counts above 1,000 cells/mm3.
3. Pleural fluid lymphocytes above 80%.
4. Chylomicrons in the pleural fluid.

They were divided into 3 groups. Group 1 included 18 patients with TG/Cholesterol ratio <1. Group 2 included 14 cases with TG/Cholesterol ratio between 1-2, and Group 3 with a TG/Cholesterol ratio >2. Forty-one patients (68.3%) responded to lone fat-free diet. Nine cases (15%) responded to fat-free steroids. Six cases (10%) responded to fat-free octreotides and 4 cases (6.66%) responded to fat free steroids octreotides regimen. The mean CT duration, ICU, requiring thoracic duct ligations, hospital stay and mortalities were significantly higher in Group 3. The most common operative procedures complicated by chylothorax were Tetralogy of Fallot (18.33%) and Glenn (18.33%). Single ventricle pathway surgeries were responsible for 40% of chylothorax cases. Redo surgeries were responsible for 31.6%. Chest tubes are usually removed

when the chest x-ray shows full lung expansion with no air leak with acceptable drainage; 2-5ml/kgm/day. All patients were followed except three non-Saudi patients and the mortality case. Monogen was routinely prescribed for one month post discharge out of the hospital. The mean follow-up was 12 months (range between 2-42 months). See Tables 1 and 2.

Discussion

The prevalence of postoperative chylothorax in children is variable between 1% or less to 4.7%. The greater the complexity of the surgery, the higher the risks and earlier feeding postoperatively. Postoperative chylothorax is the most common cause of chylothorax in children. Chylothorax post-cardiac surgery is due to direct injury to the thoracic duct, central venous thrombosis and/or high central venous pressure.[4-5-7-8-9-10]

The incidence in our study was almost 5%. It was much more post pediatric cardiac surgery than adult cardiac surgery. Our practice is to send the fluid for chyle studies (pleural fluid triglyceride cholesterol levels, blood cell counts above 1,000 cells/mm3 with lymphocytes >80% and rarely chylomicrons) once there is clinical or intra-operative suspicion; a large amount of drainage, especially after the patient is fed. We usually depend upon the presence of triglycerides more than 1.1 mmol (48 cases - 80%), and absolute pleural fluid white blood cell counts above 1,000 cells/mm3 with lymphocytes >80% (20 cases - 33.3%), and the presence of chylomicrons (10 cases - 16.6%).

We found the Pleural fluid triglyceride/cholesterol ratio >1 in 42 cases (70%). Ratio >2 was parallel to the +ve diagnosis in 70% of cases. Ratio >2 may give false +ve results if the cholesterol level is very low. In such a case, we can use a combination of both ratio and triglyceride level. Although Buttiker et. al., 1999 believe that cholesterol level is not applicable in neonates and infants as dietary fat used in their formula consists mainly of triglycerides and almost no cholesterol, and the presence of cholesterol in the effusion is not expected.[1]

Table 1. The Operative Procedure Complicated by Chylothorax.

Operation	Ratio <1 18	Ratio ( ) 1-2 14	Ratio >2 28
CAVC	4 (22.2 %)	3 (21.35%)	3 (10.7%)
Rastelli	1 (5.55%)	0	1 (3.57%)
TOF	4 (22.2 %)	4 (28.56%)	3 (10.7%)
Glenn	2 (11.1%)	0	9 (30.21%)
Fontan	3 (16.6%)	3 (21.35%)	3 (10.7%)
BTS	1 (5.55%)	2 (14.28%)	2 (7.14%)
VSD	1 (5.55%)	1 (7.14%)	1 (3.57%)
Redo VSD	0	0	1 (3.57%)
TAPVD	1 (5.55%)	0	1 (3.57%)
Definitive ASO	1 (5.55%)	1 (7.14%)	3 (10.7%)
CABG	0	0	1 (3.57%)

Table 2. Demographics, Operative Data and Results of the Three Groups

Ratio No.	Ratio <1 0.7 18	( ) 1-2 1.7 14	>2 9.5 28
Mean Age in Months	31 (1-120)	27.5 (0.5-108)	19.7 (3-720)
M/F	10/8	6/8	10/18
Single	7	4	15
Bi-Ventricle	11	10	13
Redo Surgeries	4	2	13
Mean ICU	6.5	7.2	9 S.
Mean Hospital	16.5	17.5	22.5 S.
Mean CT Amount	20.5	19	19.5
Mean CT Duration	11.5	8	16.5 S.
Diet	16 (88%)	10 (71.4%)	15 (57.5%) S.
Steroids	1 (5.5%)	1 (7.14%)	7 (25%) S.
Octreotides	1 (5.5%)	1 (7.14%)	4 (14.25%) S.
Both	0	2 (14.28%)	2 (7.125%)
Duct Ligation	0	0	2 (7.125%) S.
Recurrence	0	0	0
Death	0	0	2 (7.125%) S.

We may disagree with this thought due to the eagerness of mothers nowadays to feed their children and our patients mean age was 21 months. Once the diagnosis is confirmed, fat-free diet and / or Monogen with diuretics, and ACEI are started and optimized. If the drainage trend is going up or refractory to diet modification only, we either give steroids or octreotides with no fixed policy or justification for which we use. The predictors of prolonged chest tube drainage >21 days were single ventricle physiology, redo surgeries, Fontan, Glenn and BT shunts. Nath et.al., 2009 found 25% of the chylothoraces to be post-Fontan and 20% to be post-Glenn shunts and 5% post-Norwood.[10-11]

Truncus arteriosus repair was the most common operative procedure complicated by chylothorax in the series of Biewer et.al., 2010, followed by TGA repair and then AVSD repair.[11-12]

We had 3 patients who did not respond to the conservative treatment; the first patient was a two-year-old boy with Double Outlet Right Ventricle with Hypoplastic Right Ventricle who had a redo sternotomy and a Bidirectional Glenn shunt status post-Blalock-Taussig shunt and thrombosis of the left femoral vein. His TG/Cholesterol ratio was 4.2. His mean CT drainage was 17 ml/kg/day. Monogen was started for 10 days, followed by steroids for 5 days. However, the chest tube drainage continued profusely. It was decided to give him nothing by mouth, and to start total parenteral nutrition. After two days the plan was changed because of the non-compliance of the mother who kept giving the patient milk formula. In the end, right thoracotomy and supra-diaphragmatic ligation of the thoracic duct on the twenty-third day postoperatively was performed. The chest tube was removed on the sixth day post-duct ligation.

The second patient was a 60-year-old man with diabetic hypertensive dyslipidaemic with 3 vessel coronary artery disease and chronic renal impairment. He had CABG. He had few sessions of renal dialysis and a smooth early postoperative course for 10 days, then he started to develop chylothorax with TG/cholesterol ratio: 3.8, sepsis, multi-organ failure and prolonged the ICU stay. He did not make it and died in the ICU on the 24th postoperative day.

The third case was an 18-month-old boy with Redo Sternotomy / Hypertensive Glenn shunt with forward pulmonary blood flow. Chylothorax was diagnosed. He continued to drain profusely for almost 6 weeks with failure of TPN, steroids, octreotides and even duct ligation. Trial of occlusion of the forward flow was aborted due to extreme desaturation. He died 7 weeks post Glenn shunt. Forty-one (68.3%) cases responded to a lone fat-free. The worst response to diet modification alone was noticed in Group 3. Nine patients responded to lone fat-free + steroids; 15%

with the best response noticed in Group 3. Six cases responded to a lone fat-free + Octreotides; 10% with the best response noticed with Group 3 also. Four cases responded to lone fat-free + both steroids and octreotides; 6.6% with the best response noticed in Group 2. Three cases were non-respondent - 5%; two of them were post-redo Glenn babies, and the third one was post-CABG old man. All the non-respondent patients were in Group 3 with a TG/cholesterol ratio more than 2. We had two patients who had thoracic duct ligations, but we never had pleuro-peritoneal shunt. We did not encounter any recurrence in our study. This may be due to the relatively short follow-up duration (median of 14 months).

Conclusions

Conservative therapy of chylothorax after cardiac surgery remains the standard approach in most cases. Triglyceride cholesterol ratio can be used as an acceptable diagnostic and an excellent prognostic tool in patients with post cardiac surgery chylothorax.

Limitations

This is a retrospective study with all inherited defects of the retrospective studies with a relatively good number of patients. The patients demographics, diagnoses and operations are heterogenous. Follow-up duration was relatively short. There was no standard fixed protocol for the management of each patient in this series as regards when to send for chyle study, which modality of treatment to start, size, number, positions and types of chest tubes and when to remove them. We did not study the pro and anti coagulation, total proteins or the immunoglobulins.

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Pediatric Cardiologist with Expertise in Electrophysiology
Rank Dependent on Qualifications, Clinical or Tenure track

The Division of Pediatric Cardiology at the University of Utah School of Medicine is recruiting a Pediatric Cardiologist with expertise in Electrophysiology. The Pediatric Cardiologist will provide focused care to children and adults with congenital heart disease. Clinical activities will be carried out at Primary Children Medical Center and the Division of Cardiology outreach sites. The division has a busy arrhythmia service (over 200 invasive cases and 1200 device interrogations last year), working closely with other pediatric cardiologists, adult congenital cardiologists, cardiothoracic surgery, cardiac intensive care, and cardiac anesthesia to coordinate care. In addition to clinical service, there is an expectation for academic work, including teaching, research, administration, as well as advocacy. There will be protected time for clinical research with mentoring available within the Division.

Qualified candidates must have an M.D. or D.O. degree; be Board Qualified/Board Certified in Pediatric Cardiology; and should have a strong clinical background in all areas of pediatric cardiology with expertise in pediatric electrophysiology, including medical management of inpatients and outpatients with arrhythmias, exercise testing, interpretation of Holters, event monitors, and cardiac device interrogations, cardioversions, electrophysiology studies, intracardiac ablation and implanted arrhythmia device procedures. The selected candidate will receive a faculty appointment on the Clinical or Tenure track in the Department of Pediatrics. Rank will be dependent on qualifications.

Interested individuals can apply at
http://utah.peopleadmin.com/postings/19492.
Cover letter and curriculum vitae are required.
For additional information about the position, please contact:
Lloyd Tani, M.D., at lloyd.tani@imail.org.

The University of Utah is an Equal Opportunity/Affirmative Action employer and educator. Minorities, women, and persons with disabilities are strongly encouraged to apply. Veteran's preference. Reasonable accommodations provided. Additional information is available at: http://www.regulations.utah.edu/humanResources/5-106.html.

The University of Utah values candidates who have experience working in settings with students from diverse backgrounds, and possess a strong commitment to improving access to higher education for historically underrepresented students.

The University of Utah Health Sciences Center is a patient focused center distinguished by collaboration, excellence, leadership, and Respect. The University of Utah HSC values candidates who are committed to fostering and furthering the culture of compassion, collaboration, innovation, accountability, diversity, integrity, quality, and trust that is integral to the mission of the University of Utah Health Sciences Center.

Medical News, Products and Information

Medtronic Gains FDA Clearance for New Pediatric Oxygenation System for Neonate, Infant & Pediatric Cardiopulmonary Bypass Surgery

Advanced System Serves as Child's Lungs During Lifesaving Open-Heart Surgery and Provides Perfusionists with Options for a Broader Range of Patients

In October, Medtronic, Inc. announced the US Food and Drug Administration (FDA) 510(k) clearance and the first US clinical use of its new Affinity Pixie® Oxygenation System. The system allows for broader use in children of various sizes and easy set-up and use by perfusionists during lifesaving open-heart (cardiopulmonary bypass) surgeries in neonates, infants and small children, including those with congenital heart defects.

The Affinity Pixie Oxygenation System serves as a child's lungs during open-heart surgery by removing carbon dioxide and adding oxygen to the child's blood before returning it to the body. It also cools or warms the blood to attain the desired body temperature. During open-heart surgery, blood is routed away from the child's heart and lungs through the cardiopulmonary bypass circuit that includes the oxygenation system, thereby creating a bloodless, motionless field, which is what allows surgeons to perform complex procedures on the heart intended to correct the defect or improve heart function.

The Affinity Pixie Oxygenation System was first used in the United States at the Advocate Christ Medical Center in Oak Lawn, Ill. The Affinity Pixie Oxygenation System with Balance® Biosurface gained CE (Conformité Européenne) Mark in May 2010, and is currently available for use in more than 50 countries worldwide.

A congenital heart defect is a condition, present at birth, in one or more structures of the heart or blood vessels. Approximately 25% of the 32,000 infants born each year in the United States with congenital heart defects require invasive treatment within the first year of life[1], and some children require additional procedures as they grow older.

"Medtronic is committed to investing its resources to provide successful therapies to underserved populations, including pediatric patients," said John Liddicoat, MD, Senior VP, Medtronic and President of the Structural Heart business. "The Affinity Pixie Oxygenation System is the latest innovation in Medtronic's expanding portfolio of products for pediatric cardiac patients, which includes transcatheter pulmonic valves, cannula products, arterial filters and temporary pacing leads."

For more information visit: www.medtronic.com.

Gore Reacts to RESPECT Trial Results - Data Calls for Further Research on Transcatheter Patent Foramen Ovale (PFO) Closure

(Business Wire) W. L. Gore & Associates responded to initial results reported in St. Jude Medical, Inc.'s RESPECT clinical trial. The

CHOC Children's

Sudden Cardiac Arrest in Children and Adolescents – Current Controversies

Program Director

Anjan S. Batra, MD, FHRS
Medical Director of Electrophysiology,
CHOC Children's
Associate Professor, Clinical Pediatrics,
UCI School of Medicine

Keynote Speakers

Frank I. Marcus, MD
Professor of Medicine
Section of Cardiology
Department of Medicine
University of Arizona
Health Sciences Center

Barry J. Maron, MD
Director, Hypertrophic
Cardiomyopathy Center
Minneapolis Heart Institute
Foundation
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Medical Director of Electrophysiology, CHOC Children's
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Pauline and Harold Price Professor Associate Director, Heart Institute Director, Cardiac Electrophysiology
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Professor of Medicine
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University of Arizona Health Sciences Center

Barry J. Maron, MD - Key Note Speaker
Director, Hypertrophic Cardiomyopathy Center
Minneapolis Heart Institute Foundation
Minneapolis, MN

Jeremy Moore, MD
Pediatric Cardiology, Children's Hospital UCLA

RESPECT study investigated whether transcatheter closure of PFO using St. Jude's AMPLATZER® PFO Occluder device is safe and effective compared to best medical therapy in the prevention of recurrent cryptogenic stroke. Gore is concurrently conducting its Gore REDUCE Clinical Study using both the Gore HELEX® Septal Occluder and, as reported earlier this week, the new Gore® Septal Occluder in patients with PFO and a history of cryptogenic stroke or imaging-confirmed transient ischemic attack (TIA).

Stuart Broyles, PhD, Associate with the Gore Medical Division Stroke Business, commented, "Our commitment is to patients suffering from cryptogenic strokes and bringing them viable and beneficial treatment options. Our goal is to reduce recurrent stroke and improve the quality of life for patients. The RESPECT study data suggest closure therapy for PFO may be beneficial, but further research is required. Gore is committed to the pursuit of a PFO indication in the US for the GORE HELEX Septal Occluder and the GORE Septal Occluder. Worldwide, these Gore devices have a strong record of patient safety. We will continue to pursue the indication for our devices through the Gore REDUCE Clinical Study. Gore looks forward to further review of the RESPECT data in the coming weeks."

For more information visit: www.clinical.goremedical.com/REDUCE.

Request for Survey Participation: Cardiologists' Attitudes and Practices Regarding Genetic Testing For HCM

Are you a cardiologist who sees patients with Hypertrophic Cardiomyopathy (HCM)?

Please take this 10 minute online, anonymous survey - http://vovici.com/wsb.dll/s/ca61g5136d regarding genetic testing for HCM.

Upon completion, the respondent will obtain further resources refreshing them on the current practices and guidelines regarding genetic testing for HCM.

Thank you in advance for your participation. Your time and input are valuable and very much appreciated.

- Yi-Lee Ting, BS; Northwestern University; Genetic Counseling Program
- Lisa Dellefave-Castillo, MS; Certified Genetic Counselor; The University of Chicago, Section of Cardiology
- Elizabeth McNally, MD, PhD; Professor, Department of Medicine; Director, Institute for Cardiovascular Research; The University of Chicago

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Coping Skills, Marital Satisfaction Help Pregnant Moms Manage Stress When Fetus Has Heart Defect

Newswise — Expectant mothers who learn from prenatal diagnosis that they are carrying a fetus with a congenital heart defect (CHD) commonly suffer post-traumatic stress, depression and anxiety. However, a healthy relationship with one's partner and positive coping mechanisms can reduce this intense stress, according to new research from the Cardiac Center of The Children's Hospital of Philadelphia and published in the September 2012 issue of *The Journal of Pediatrics*.

Children's Mercy HOSPITALS & CLINICS | Kansas City

The Ward Family Heart Center

Children's Mercy Hospitals & Clinics – Kansas City

The Ward Family Heart Center at Children's Mercy Hospitals & Clinics in Kansas City serves a population of over 5 million in the heart of the U.S.A. The team includes 15 cardiologists, 2 surgeons, and 17 Advance Practice Nurses. We perform over 500 cardiac operations, 800 cardiac catheterization and 300+ EP procedures, 12,000 outpatient visits and 14,000 echocardiograms annually. Our preoperative and postoperative ICUs include a 41-bed PICU (including a brand-new 14-bed Cardiac Wing) and a 70-bed NICU. There is a wealth of opportunity to develop and participate in research programs and data collection in many areas related to heart care in children.

Interventional Cardiologist

We seek an experienced academic individual to join our team of 4 interventionalists. Candidates must be board-certified in Pediatric Cardiology, have completed one year of training in Pediatric Interventional Cardiology, and have greater than 3 years experience working as an Interventional Cardiologist in a tertiary heart center. They should be academicians with demonstrated research productivity.

Inpatient Cardiologist

We seek two Inpatient Cardiologists with experience in a tertiary cardiac center to join our team. Inpatient cardiologists provide consultative expertise to the care of pre- and post-operative patients in the NICU and PICU. Candidates must be fellowship trained, board-eligible or board-certified in Pediatric Cardiology. They should be prepared to lead a team that includes extensive support from nurse practitioners and fellows. Candidates with interest and experience in other aspects of cardiology such as imaging, non-invasive electrophysiology and outpatient cardiology are welcomed. A track record of research productivity is required.

Candidates should be qualified for academic appointment at the rank of Assistant or Associate Professor. Salary and academic range are commensurate with experience. EOE/AAP

For additional information contact:
Girish Shirali, MD (gsshirali@cmh.edu)
Cardiology Division Chief and
Medical Co-Director of the Heart Center
Send Curriculum Vitae to: physicianjobs@cmh.edu

Adult Congenital Heart Disease (ACHD) Specialist

Opportunity
The Heart Center at Akron Children's Hospital seeks a second adult congenital heart disease (ACHD) specialist to join an established, yet rapidly expanding program. Candidates with training or expertise in the care of adults with congenital heart disease and with appropriate board eligibility will be considered. This outstanding opportunity is an academic/clinical position with appointment at Northeast Ohio Medical University available.

Ranked a best children's Hospital by US News and World Report in Cardiology and Heart Surgery, the Heart Center at Akron Children's Hospital provides advanced cardiac care from the fetus to the adult with congenital heart disease. Join a dedicated team of 10 pediatric cardiologists and 2 cardiovascular surgeons who are committed to providing extraordinary patient care and service to patients throughout northeast Ohio.

Hospital Overview
Akron Children's Hospital is the largest pediatric healthcare system in Northeast Ohio, serving over 600,000 patients each year. With two free-standing pediatric hospitals and 20 primary care offices, the Akron Children's Hospital system provides services at nearly 80 locations across an urban, suburban and rural region of Ohio. The services and subspecialties at Akron Children's Hospital span the entire scope of medical services available today – from routine and preventative care to emerging technologies in surgery and patient care.

Akron Children's is dedicated to family-centered care, and improving the treatment of childhood illness and injury through research at the Rebecca D. Considine Clinical Research Institute. Quality is a strategic focus of Akron Children's Hospital through the Mark A. Watson Center for Operations Excellence, using tools such as Lean Six Sigma.

Community Overview
Akron Children's Hospital is set in the beautiful Cuyahoga Valley, just minutes south of Cleveland. From major league attractions to small-town appeal, the greater Akron area and Northeast Ohio has something for everyone. The area is rich in history and cultural diversity, and provides a stimulating blend of outstanding educational, cultural and recreational resources. This four-season community will have outdoor enthusiasts thrilled with over 40,000 acres of Metro Parks for year round enjoyment. Northeast Ohio is gaining a reputation as a world-class center for research and development in a variety of high-tech industries, and has become a premiere destination to work, live, play, shop and dine!

Candidates may submit their curriculum vitae to:
Lori Schapel, FASPR
Akron Children's Hospital
One Perkins Square
Akron, OH 44308
(330) 543-5082
or via e-mail to: lschapel@chmca.org

Akron Children's Hospital

Washington University in St. Louis

SCHOOL OF MEDICINE

Echocardiography, Fetal Echocardiography and/or Noninvasive Imaging

The Department of Pediatrics of Washington University School of Medicine in St. Louis, is seeking two pediatric cardiologists to join our team of 13 clinicians and basic scientists, based at St. Louis Children's Hospital.

We seek to recruit two cardiologists with a primary interest in echocardiography, ideally with a focus on either fetal echocardiography or noninvasive imaging. Currently our program performs approximately 400 fetal studies yearly. In addition, the Mallinckrodt Institute of Radiology at Washington University is an important resource for research and patient care, with state-of-the-art imaging capabilities. There is also the opportunity to participate in the development of the recently-established Fetal Care Center, a joint program of St. Louis Children's Hospital, Barnes-Jewish Hospital and Washington University. The ideal candidate must be eligible for licensure in Missouri, be board certified (or eligible) in pediatric cardiology, be skilled in echocardiography, and have had advanced training and experience in fetal echocardiography and/or noninvasive imaging.

Interested candidates should provide a curriculum vitae and contact:

George F. Van Hare, M.D.
Director, Pediatric Cardiology
Co-Director, St. Louis Children's Heart Center
1 Children's Place
St. Louis, MO 63110
e-mail: vanhare@kids.wustl.edu
Phone: 314-454-4217

Heart Failure/Transplant Pediatric Cardiologist

The Department of Pediatrics of Washington University School of Medicine in St. Louis, is seeking one pediatric cardiologist to join our team of 2 heart failure/transplant pediatric cardiologists with a division of 13 clinicians and basic scientists, based at St. Louis Children's Hospital.

We seek to recruit a third pediatric cardiologist to join our dedicated Heart Failure/Transplant service established in 2012. St. Louis Children's Hospital is one of the largest pediatric heart failure transplant centers in North America performing approximately 20 transplants a year over the past 5 years with a growing pediatric VAD service. The Heart Failure /Transplant service has a long tradition of involvement in multicenter research including the Pediatric Heart Transplant Study, Pediatric Cardiomyopathy Registry, the Carvedilol Trial, the Berlin Heart Trial, and the NIH- supported CTOT study. Other opportunities for other clinical and basic science research in pediatric heart transplantation exist within the institution. The ideal candidate must be eligible for licensure in Missouri, be board certified (or eligible) in pediatric cardiology. Experience in pediatric heart failure and transplantation is desirable, but not a prerequisite for the position.

Interested candidates should provide a curriculum vitae and contact:

Charles E. Canter, M.D.
Medical Director
St. Louis Children's Hospital Heart Failure/Transplant Program
1 Children's Place
St. Louis, MO 63110
e-mail: canter@kids.wustl.edu
Phone: 314-454-2214

Washington University School of Medicine is consistently ranked as one of the best medical schools in the country, and is a longstanding leader in funding for pediatric research. St. Louis Children's Hospital is a 250 bed free-standing children's hospital established in 1879, and is listed on the U.S. News and World Report Honor Roll of best children's hospitals, attesting to its strong programs in all aspects of children's health care. The St. Louis Children's Heart Center includes an active surgical program, a 12-bed Cardiac Intensive Care Unit, a strong fellowship program, and established clinical excellence in all disciplines of pediatric cardiology. In addition to the 2 current physician members, the Heart Failure/Transplant Service includes 5 transplant coordinators, including 2 PNPs, dedicated clerical and clinical research coordinator support, and active participation of the fellow trainees within the service.

Washington University is an Equal Opportunity Affirmative Action Employer. We welcome CVs and resumes from women and from minority candidates.

"Receiving the news of carrying a fetus with a CHD is a stressful event which can potentially influence a mother's anxiety level," said study leader Jack Rychik, MD, Medical Director of the Fetal Heart Program in the Cardiac Center at The Children's Hospital of Philadelphia. "Prenatal diagnosis is helpful in that it gives parents time to learn about the defect, review treatment options, plan for necessary interventions and consider their options. While this is intrinsically a stressful time for parents, there has previously been little research on the details of this stress and ways to buffer it."

The researchers surveyed 59 pregnant mothers, ranging in gestational age from 17 to 31.5 weeks, who were recruited by nurse coordinators at either the initial visit to the Fetal Heart Program or a follow-up visit, then followed throughout the rest of their gestation. Participants intended to continue the pregnancy, and to plan for follow-up with the Fetal Heart Program. All were carrying fetuses with serious CHD requiring neonatal evaluation and postnatal surgical or catheter-based intervention within the first six months of life.

Using psychological evaluation tools and self-report instruments, the study team measured traumatic stress, depression and anxiety among the mothers. The researchers also measured partner satisfaction and collected demographic data.

More than 39% of the women experienced clinically important traumatic stress, 22% experienced depression, and 31% experienced state anxiety. Lower partner satisfaction and lower income were both associated with higher levels of depression, anxiety and traumatic stress. When the researchers controlled for partner satisfaction and income, they found denial to be most important factor contributing to depression.

"Prenatal diagnosis of CHD is a traumatic event for many pregnant women. In our study we found that a substantial proportion of mothers exhibited evidence for traumatic stress, with nearly 40% exceeding clinical cut-off points for post-traumatic stress disorder," said Guy S. Diamond, PhD, a psychologist at The Children's Hospital of Philadelphia who participated in this study.

"While individual coping skills are important, partner satisfaction may better predict a more resilient response to the stress of prenatal CHD," Diamond added. We have identified 'denial' as an important contributor to depression and that on-going counseling sessions should focus on this risk factor."

"This study is the beginning, and more research needs to be done to ensure we are giving mothers the very best multidisciplinary care. In one way, the families are fortunate to know in advance that their baby has a CHD and in another way given more stress with that knowledge. In the future, optimal management strategies to improve outcomes for both mom and fetus will include stress reduction techniques, which should accompany the diagnosis of CHD prior to birth," added Rychik.

Dr. Rychik's co-authors are: Denise D. Donaghue, RN, MSN; Suzanne Levy, PhD; Clara Fajardo, MS; Jill Combs, RN, MSN; Xuemei Zhang, MS; Anita Szwast, MD, and Guy S. Diamond, PhD, all from The Children's Hospital of Philadelphia.

Dr. Rychik is supported in part by the Robert and Dolores Harrington Endowed Chair in Pediatric Cardiology.

For more information, visit www.chop.edu.

JANUARY MEETING FOCUS

Pediatric & Adult Interventional Cardiac Symposium (PICS & AICS 2013)
Jan. 19-22, 2013; Miami, FL USA
www.picsymposium.com

Course Directors: Ziyad M. Hijazi; John P. Cheatham; Carlos Pedra; Thomas Jones; William Hellenbrand (Director Emeritus)

Co-Directors: Damien Kenny; Giacomo Pongiglione; Clifford Kavinsky; Ralf Holzer

Overview:

- Focus on the latest Advances Interventional Therapies for Children and Adults
- Special Imaging Session - congenital and structural cardiovascular therapies
- Daily Breakout Sessions
- Daily Debates
- Live Case Demonstrations from International Centers
- The Popular "My Nightmare Case in the Cath Lab"
- Oral and Poster Abstract Presentations
- PICS/AICS Achievement Award

Invited Faculty: Teiji Akagi, Hakan Akpinar, Mansour Al-Jufan, BG Alekyan, Mazeni Alwi, Zahid Amin, Raul Arrieta, Emile Bacha, Steven Bailey, David Balzer, John Bass, Lee Benson, Lisa Bergersen, Darren Berman, Jacek Bialkowski, Werner Budts, Qi-Ling Cao, Massimo Caputo, Mario Carminati, John Carroll, Francisco Chamie, Jae Young Choi, Roberto Cubeddu, Bharat Dalvi, Jo De Giovanni, Michael de Moor, Karim Diab, Makram Ebeid, Howaida El-Said, Maiy El Sayed, Horacio Faella, Thomas Fagan, Ted Feldman, Craig Fleishman, Mark Fogel, Simone Fontes-Pedra, Thomas Forbes, Olaf Franzen, Yun Ching Fu, Mark Galantowicz, Wei Gao, Marc Gewillig, Matt Gillespie, Omar Goktekin, Miguel Granja, Daniel Gruenstein, Donald Hagler, James Hermiller, and others

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