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Medium-Term Outcomes for Children with Severe Hyperlactatemia after Heart Surgery

By Anthony F. Rossi, MD; Robert L. Hannan, MD; Juan Bolivar, MD; Nancy Dobrolet, MD; Plato Alexander, MD and Redmond P. Burke, MD

Introduction

Measurement of blood or serum lactate levels in the critically ill is now common place. Serial lactate monitoring has been used as an end point of resuscitation in critically ill patients undergoing goal-directed protocols.[1-3] Lactate monitoring has also been shown to be an excellent prognosticator of hospital mortality in critical illness, including infants and children recovering after congenital heart surgery.[4-8] While it is currently well-accepted that those patients with significant elevation of blood lactate are at high risk of dying in the hospital during their illness, the medium-term impact of such a significant physiologic aberration and its influence on the continued risk of dying after hospital discharge has not been evaluated.

Methods

The web-based medical records of all patients undergoing congenital heart surgery at Miami Children's Hospital between March 2002 and March 2005 were reviewed. Patients undergoing ligation of a patent ductus arteriosus as the primary procedure were excluded. All patients recovering after congenital heart surgery had serial lactate values measured according to our previously published protocol.[3] Briefly, whole blood lactate was measured with a handheld point-of-care device (i-STAT 1 blood gas analyzer, Abbott PoC, Princeton, NJ) on admission to the cardiac intensive care unit and at predetermined intervals thereafter. An algorithm was developed to direct physician response to changing lactate levels. Routine measurement of blood lactate was discontinued when the blood lactate level returned to normal (<2.2 mmoles/L for the purpose of our study). In neonates, blood lactate was measured hourly for the first 4 to 6 hours after admission to the CICU. If the lactate level was less than 5 mmoles/L or if the lactate trend was acceptable (decrease of more than 0.5 mmoles/L per hour), lactate was measured every 4 to 6 hours until normal. For all other patients lactate was measured serially every 4-6 hours. Lactate could also be measured at the physician's discretion. Lactate testing was

> ***"Lactate monitoring has also been shown to be an excellent prognosticator of hospital mortality in critical illness, including infants and children recovering after congenital heart surgery.[4-8]"***

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Table 1. Patient Demographics				
	Number of Patients	**Median Age (range)**	**Median LOS (range)**	**% Neonates**
Group I	1209	161d * (1d-54.1y)	9d # (1-188d)	26%**
Group II	17	16d (1d-19.8y)	22d (4-108d)	53%
Group III	9	7d (5d-14 y)	51.8d (38-73d)	78%

** p=0.001 vs. Group II and Group III. # p<0.01 vs. Group II and III. ** p=<0.01 vs. Group I and Group III.*

Table 2. Group II Patients				
Diagnosis	**Procedure**	**Age at Surg (days)**	**POS (days)**	**Outcome**
HLHS	Norwood Stage 1	10	149	HM
HLHS	Norwood Stage 1	16	28	HM
HLHS	Fontan	5485	31	HM
TAPVC mixed	TAPVC repair	1	18	HM
AS/AI	Ross/Konno	4133	19	A
TOF s/p repair	RVOT homograft	5072	31	A
TOF s/p repair	RVOT homograft	5351	11	A
Sinus Valsalva Aneurysm	Repair	7203	8	A
HLHS	Norwood Stage 1	6	20	A
Coarctation	Coarct repair (CPB)	8	11	A
HLHS	Norwood Stage 1	8	16	A
TGA	ASO	11	11	A
TAPVC s/p repair, PVSten	Repair PV stenosis	63	12	A
AS/AI	Ross	3034	12	A
DCRV	Repair	4007	4	A
HLHS	Norwood Stage 1	13	95	A

Abbreviations: HLHS: Hypoplastic Left Heart Syndrome; TAPVC mixed: total anomalous pulmonary venous connection, mixed type; AS/AI: aortic stenosis/aortic insufficiency; TOF: Tetralogy of Fallot; Coarctation: coarctation of the aorta; TGA: complete transposition of the great arteries; PV Sten: pulmonary vein stenosis; DCRV: double chambered right ventricle; RVOT: right ventricular outflow tract; ASO; arterial switch operation; HM: hospital mortality; A: currently alive.

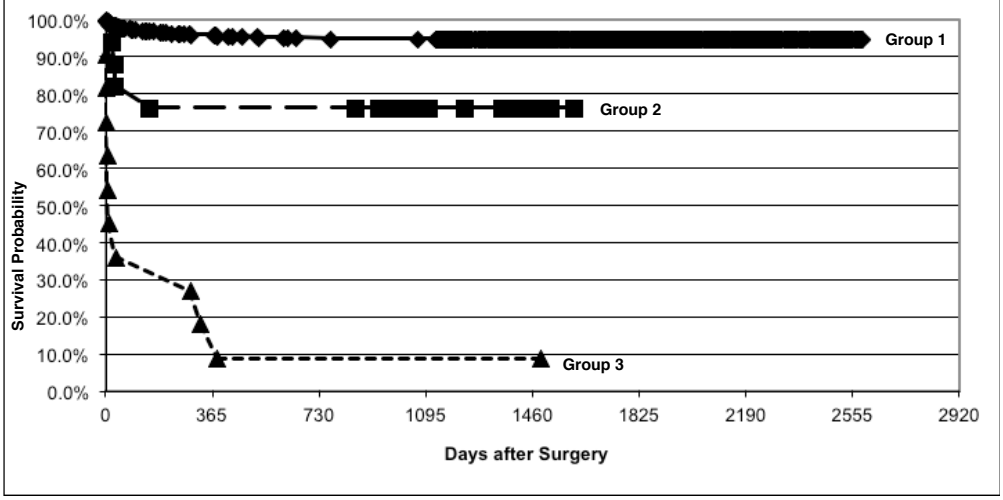

Figure 1. Kaplan-Meier Survival Curve of patients undergoing congenital heart surgery.

repeated serially until normal or until the lactate trend was consistent with a favorable outcome.[8] For the purpose of this study SL was defined as a measured whole blood lactate level >10 mmoles/l.

Patients were divided into three groups:

- Group I: Patients never experiencing postoperative SL,
- Group II: SL resolved within the first 24 hours after admission to the CICU,
- Group III: SL beginning in the first 24 hours after surgery and persisting for greater than 24 hours after admission to the CICU.

Patients who normalized their blood lactate level within 24 hours of surgery, but had a secondary late increase in lactate, and patients who experienced SL for the first time later than 24 hours after admission were included in either Group I or Group II, depending on the highest lactate level they obtained in the first 24 hours after surgery. Mortality was measured at the following time intervals: prior to hospital discharge, one year after discharge and at a mean follow-up of 5.1 years (+/- 1.1 years).

Statistical analysis was performed using Sigma Stat for Windows Version 2.03, SPSS Inc (Chicago, IL). Chi-Square analysis was used to detect differences in mortality between groups. The Fisher exact test was used when appropriate. Mann-Whitney Rank Sum Analysis was used to determine differences in demographic data between groups.

Results

Demographics for the entire group are displayed in Table 1. Groups II and III are described in Tables 2 and 3. The majority of patients experiencing prolonged SL were neonates. Group I patients were older than either Group II or Group III patients (p=0.001 comparing Group I to both Group II and Group III). Neonates comprised only about a quarter of the patients who were in Group I, but over 50% of Group II and almost 80% of Group III. A statistically higher percentage of patients were neonates when comparing either Group II or Group III with those in group I (p<0.01 for both). There was no significant difference in the percentage of neonates between Groups II and III. Length of stay was significantly longer for those patients experiencing SL and prolonged SL was associated with the longest postoperative stays.

Patients in Group I had significantly lower mortality at discharge, one year and at medium term follow-up than either Groups II or III (Table 4). Group II patients had statistically lower mortality than Group III patients at one year and at medium-term follow-up, and a lower mortality at hospital discharge that approached significant difference (p=0.06). The Kaplan-Meier Survival Curve for all patients is displayed in Figure 1.

Table 3. Group III Patients				
Diagnosis	**Procedure**	**Age at Surg (days)**	**POS (days)**	**Outcome**
HLHS	Norwood Stage 1	6	4	HM
HLHS	Norwood Stage 1	5	3	HM
Tricuspid Atresia	Shunt, MBTS	4	34	HM
TAPVC Single V	TAPVC repair shunt	7	3	HM
Mitral Stenosis	Mitral Valve replacement	5096	10	HM
TOF	TOF repair	94	71	<1 YR
HLHS	Norwood Stage 1	13	40	<1 YR
HLHS	Norwood Stage 1	6	41	>1 YR
HLHS	Norwood Stage 1 (Sano)	5	33	A

Abbreviations: HLHS: Hypoplastic Left Heart Syndrome; TAPVC mixed: total anomalous pulmonary venous connection; Single V: single ventricle; TOF: Tetralogy of Fallot; MBTS: modified Blalock-Taussig shunt; HM: hospital mortality; < 1 YR: mortality within 1 year of discharge; >1 YR: mortality occurring greater than 1 year after discharge.

There were three deaths that occurred after discharge, all in Group III patients. The deaths occurred at 229, 288 and 382 days after their initial surgery. The first patient had undergone a Norwood operation for Hypoplastic Left Heart Syndrome and then a bi-directional Glenn shunt. Myocardial pump function was markedly depressed prior to the bi-directional Glenn and did not improve after this volume unloading operation. The patient was referred to a transplant center and died awaiting transplant. The second death occurred in a former premature infant who underwent repair of Tetralogy of Fallot at 3 months of age and 2.3 kilograms. A sudden, unexpected hypoxic arrest occurred on postoperative Day 2, and the patient suffered a severe hypoxic brain injury. He died unexpectedly at home. The third patient underwent a successful Norwood operation but had a prolonged and complicated postoperative course that included two runs of mechanical circulatory support. An uneventful bi-directional Glenn operation was preformed at six months of age. This patient collapsed at home and arrived at a local emergency department in extremis and died there.

Discussion

While mortality for children undergoing congenital heart surgery continues to diminish, it remains substantial for certain high risk patients and procedures.[9,10] Surgical modifications have had significant impact on mortality, but those responsible for caring for this fragile subset of postoperative patients must continue to find ways to improve clinical outcomes.

Measurement of blood lactate is now performed routinely by many clinicians who care for patients recovering after congenital heart surgery.[3,7,11] Lactate is a byproduct of glycolysis. Without oxygen, pyruvate is unable to enter the Krebs Cycle and is transformed into lactate to maintain ATP production. Lactate has repeatedly shown to predict morbidity and mortality in critical illness, including patients undergoing congenital heart surgery.[8,12,13]

Elevated lactate in critical illness is often related to a deficiency in systemic oxygen delivery (such as those patients with cardiogenic or hemorrhagic shock), a derangement of cellular aerobic metabolism (usually seen in patients with septic shock), an increase in oxygen consumption, or a combination of these events. Regardless of the mechanism of diminished availability of oxygen to various tissue beds, hypoxia at the cellular level results in a switch from aerobic to anaerobic metabolism, with a resultant increase in lactate production.

Lactate monitoring in the critically ill has traditionally fallen into one of two categories: first, as an accurate predictor of clinical outcome; second, as an objective indicator of the effectiveness of resuscitation of the critically ill. Blood lactate levels have previously proven to be an excellent prognosticator for patients recovering after congenital heart surgery.[7,8,11,12,13] Interestingly, patients experiencing hyperlactatemia in our series did appear to fare much better than those reported from earlier series.[12,13] In the series of patients reported by Siegel, a blood lactate level of 4.2 mmoles/l had a positive predictive value of postoperative death of 100%. A blood lactate level of less than 10 mmoles/l in our series placed the patient at very low risk for death. It is difficult to speculate why patients being operated on in this era seem to tolerate hyperlactatemia better than in the past. One could hypothesize that the knowledge gained from these earlier studies heightened the clinicians' awareness of the critical importance of hyperlactatemia. This might have lead to a heightened sense of urgency to correct aberrancies in the relationship between oxygen delivery and oxygen consumption at the earliest possible time, thus resulting in improved outcomes. There have also been other important clinical advances in the years separating these reports. Advances in drug therapy

Table 4. Mortality												
	Hospital Mortality				**One Year Mortality**				**Medium Term Mortality**			
	% mortality	**p value (vs. Group)**			**% mortality**	**p value (vs. Group)**			**% mortality**	**p value (vs. Group)**		
		G I	**G II**	**G III**		**G I**	**G II**	**G III**		**G I**	**G II**	**G III**
Group I	1.6	X	<0.001	<0.001	3.3	X	<0.001	<0.001	4	X	<0.001	<0.001
Group II	24		X	=0.06	24		X	<0.01	24		X	<0.01
Group III	64			X	82			X	91			X

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include the now rather routine use of the inodilator milrinone.[14] Significant progress has also been made in the area of cardiopulmonary support in the perioperative period, which has improved outcomes for all patients undergoing congenital heart surgery.[15, 16] More recently, serial blood lactate monitoring has been proven to be a valuable end organ of resuscitation for patients undergoing goal-directed therapy in critical disease.[3, 17]

The highest or peak lactate level a patient experiences during a critical illness may not be the best predictor of clinical outcomes. The time it takes to normalize blood or serum lactate (lactime) has shown to be an excellent prognosticator of outcomes in critical illness and may be superior in this respect to peak lactate measurements.[4] Prolonged lactate clearance was proven to be a better predictor of poor outcome than initial or peak lactate in some studies.[4, 8]

Moderate to severe elevation in lactate in patients following congenital heart surgery is most likely related to inadequate tissue oxygen delivery (leading to increased lactate production), and often associated with liver and renal dysfunction (the organs primarily responsible for the metabolism of lactate, leading to decreased metabolism of lactate). The aberration in the relationship between oxygen delivery and oxygen consumption may be the result of diminished oxygen delivery or increased oxygen consumption in the face of a normal, but relatively limited oxygen supply.[18] Improving tissue oxygen delivery or diminishing oxygen consumption in this population may, therefore, diminish the production of lactate and increase the metabolism of lactate (by improving both renal and hepatic function). Patients recovering from congenital heart surgery are noted to have evidence of inadequate oxygen delivery that usually resolves within 24 hours of surgery in survivors.[19,20,21] Estimating the adequacy of oxygen delivery in this patient population remains difficult. Intracardiac shunting and small patient size makes techniques such as mixed venous oxygen saturation monitoring or thermodilution cardiac output monitoring difficult, if not impossible, for many patients. Blood lactate sampling becomes an excellent, noninvasive indicator of adequate tissue oxygen delivery.

"Efforts made to prevent or limit the degree and duration of hyperlactatemia in the child recovering after congenital heart surgery, in the hopes of improving the relationship between oxygen delivery and oxygen consumption early in the postoperative course, might lead to improved early outcomes."

Patients in our study who experienced severe hyperlactatemia, even for short periods of time, faired significantly worse than those who did not. With elevations of blood lactate of 10 or greater, survival to discharge became unlikely. When prolonged for greater than 24 hours, patients experiencing SL after heart surgery were noted to have very high hospital mortality, and had a continued risk for mortality following discharge that the other groups did not experience. It is not clear why some patients in our study experienced prolonged SL. Continued diminished systemic oxygen delivery, elevated oxygen consumption, and poor end-organ function with an inability to metabolize or excrete lactate efficiently, or a combination of these phenomena, might be contributing factors. Regardless of the cause of prolonged SL in our patient population, the short- and medium-term outcomes for these patients appears to be very poor.

Limitations

Limitations of this study are those implicit in any retrospective review study. Patients in this review were managed at the clinician's discretion with intent to optimize the outcome for the individual patient. This will lead to some significant practice variations between patients. The number of patients with prolonged SL in this study was very small. A larger study might add more insight as to the fate of these markedly distressed patients. Also, the level of hyperlactatemia that we labeled as severe is completely arbitrary but consistent with early data on lactate and survival as reported by Iberti.[22]

Conclusions

Patients experiencing SL have predictably morbid outcomes. Severe elevation in blood lactate after heart surgery in children is associated with a significant risk for hospital mortality. Even short periods of SL are associated with increased risk of death and prolonged hospital stays. The outlook for patients who experience prolonged SL is particularly bleak. The hemodynamic derangements resulting in the development of prolonged SL are associated with long standing consequences. Even those fortunate enough to survive their hospital stay remain at increased risk of death after discharge.

Efforts made to prevent or limit the degree and duration of hyperlactatemia in the child recovering after congenital heart surgery, in the hopes of improving the relationship between oxygen delivery and oxygen consumption early in the postoperative course, might lead to improved early outcomes.

References

1. Backer DD. Lactic acidosis. Intensive Care Med. 2003;29:699-702.
2. Luft FC. Lactic acidosis update for critical care clinicians. J Am Soc Nephrol. 2001;12:S15-S19.
3. Rossi AF, Khan DM, Hannan R, Bolivar J, Zaidenweber M, Burke R. Goal-directed medical therapy and point-of-care testing improve outcomes after congenital heart surgery. Intensive Care Med. 2005 Jan;31(1):98-104.
4. Bakker J, Gris P, Coffernils M et al. Serial blood lactate levels can predict the development of multiple organ failure following septic shock. Am J Surg 1996; 171:221-6.
5. Jeng JC, Jablonski K, Bridgeman A, Jordan MH. Serum Lactate, not base deficit, rapidly predicts survival after major burns. Burns 2002; 28:161-166.
6. Husain FA, Martin MJ, Mullenix PS, et al. Serum lactate and base deficit as

predictors of mortality and morbidity. Am J Surg 2003;185:485-491.
7. Charpie JR, Dekeon MK, Goldberg CS, et al. Serial blood lactate measurements predict early outcome after neonatal repair or palliation for complex congenital heart disease. J Thorac Cardiovasc Surg 2000;120:73-80.
8. Kalyanaraman M, DeCampli WM, Campbell AI, Bhalala U, Harmon TG, Sandiford P, McMahon CK, Shore S, Yeh TS. Serial blood lactate levels as a predictor of mortality in children after cardiopulmonary bypass surgery. Pediatr Crit Care Med. 2008 May;9(3): 285-8.
9. Jenkins KJ, Gauvreau K, Newburger JW, Spray TL, Moller JH, Iezzoni LI. Consensus-based method for risk adjustment for surgery for congenital heart disease. J Thorac Cardiovasc Surg. 2002 Jan;123(1):110-8.
10. Lacour-Gayet F, Clarke D, Jacobs J, Comas J, Daebritz S, Daenen W, Gaynor W, Hamilton L, Jacobs M, Maruszsewski B, Pozzi M, Spray T, Stellin G, Tchervenkov C, Mavroudis And C; Aristotle Committee. The Aristotle score: a complexity-adjusted method to evaluate surgical results.Eur J Cardiothorac Surg. 2004 Jun;25(6): 911-24.
11. Robert L. Hannan, MD*, Marion A. Ybarra, BS, Jeffrey A. White, MS, Jorge W. Ojito, CCP, Anthony F. Rossi, MD, Redmond P. Burke, MD. Patterns of Lactate Values after Congenital Heart Surgery and Timing of Cardiopulmonary Support. Ann Thorac Surg 2005;80:1468-1474.
12. Siegel LB, Dalton HJ, Hertzog JH, Hopkins RA, Hannan RL, Hauser GJ. Initial postoperative serum lactate levels predict survival in children after open heart surgery Intensive Care Med 1996;22:1418-1423.
13. Cheifetz IM, Kern FH, Schulman SR, Greeley WJ, Ungerleider RM, Meliones JN. Serum lactates correlate with mortality after operations for complex congenital heart disease Ann Thorac Surg 1997;64:735-738.
14. Hoffman TM, Wernovsky G, Atz AM, Kulik TJ, Nelson DP, Chang AC, Bailey JM, Akbary A, Kocsis JF, Kaczmarek R, Spray TL, Wessel DL. Efficacy and safety of milrinone in preventing low cardiac output syndrome in infants and children after corrective surgery for congenital heart disease. Circulation. 2003 Feb 25;107(7):996-1002.
15. Hannan RL, Ojito JW, Ybarra MA, O'Brien MC, Rossi AF, Burke RP. Rapid cardiopulmonary support in children with heart disease: a nine-year experience. Ann Thorac Surg. 2006 Nov;82(5):1637-41.
16. Cooper DS, Jacobs JP, Moore L, Stock A, Gaynor JW, Chancy T, Parpard M, Griffin DA, Owens T, Checchia PA, Thiagarajan RR, Spray TL, Ravishankar C. Cardiac extracorporeal life support: state of the art in 2007. Cardiol Young. 2007 Sep;17 Suppl 2:104-15.
17. Jansen TC, van Bommel J, Schoonderbeek FJ, Sleeswijk Visser SJ, van der Klooster JM, Lima AP, Willemsen SP, Bakker J; LACTATE study group. Early lactate-guided therapy in intensive care unit patients: a multicenter, open-label, randomized controlled trial. Am J Respir Crit Care Med. 2010 Sep 15;182(6):752-61.
18. Li J, Zhang G, Benson L, Holtby H, Cai S, Humpl T, Van Arsdell GS, Redington AN, Caldarone CA. Comparison of the profiles of postoperative systemic hemodynamics and oxygen transport in neonates after the hybrid or the Norwood procedure: a pilot study. Circulation. 2007 Sep 11;116(11 Suppl):I179-87.
19. Rossi AF, Seiden HS, Gross RP, et al. Oxygen transport in critically ill infants after congenital heart operations. Ann Thorac Surg 1999; 67:739-44.
20. Rossi AF, Sommer RJ, Lotvin A, et al. Usefulness of intermittent monitoring of mixed venous oxygen saturation after Stage I palliation for hypoplastic left heart syndrome. Am J cardiol 1994;73:1118-1123.
21. Hoffman GM, Ghanayem NS, Kampine JM, Berger S, Mussatto KA, Litwin SB, Tweddell JS .Venous saturation and the anaerobic threshold in neonates after the Norwood procedure for hypoplastic left heart syndrome. Ann Thorac Surg. 2000 Nov;70(5):1515-20.
22. Iberti, T. J., Leibowitz, A. B., Papadakos, P. J., and Fischer, E. P. (1990). Low sensitivity of the anion gap as a screen to detect hyperlactatemia in critically ill patients. Critical Care Medicine, 18(3), 275.

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Highlights from the 3rd Congress of Congenital Heart Disease: "Ventricular Septal Defect from A to Z" -

HCMC Pediatric Cardiology and Congenital Heart Disease Society Annual Meeting - January 9-11, 2013, Ho Chi Minh City, Vietnam

By Casey Culbertson, MD; Do Nguyen Tin, MD; Le Trong Phi, MD; Nguyen Lan Hieu ,MD, PhD; Vu Minh Phuc, MD

From left-to-right: Drs. Pronthep Lertsapcharoen (Thailand); Kai-Sheng HSIEH (Taiwan); Shakeel A. Qureshi (UK); Bharat Dalvi (India); and Neil Wilson (UK).

Introduction

The 3rd Annual Congress sponsored by the Ho Chi Minh City (HCMC) Pediatric Cardiology and Congenital Heart Disease Society titled *Congress of Congenital Heart Disease: Ventricular Septal Defects (VSD) from A to Z* took place at the Sheraton Saigon Hotel & Towers from January 9-11, 2013. This meeting featured a world class faculty including: Dalvi Bharat, Hoang Trong Kim, Le Trong Phi, Lee Benson, Mohammed Omar Galal, Neil Wilson, Nina Wunderlich, Pham Nguyen Vinh, Shakeel Qureshi and Vu Minh Phuc as course directors. Over 300 participants from the USA, England, Germany, Saudi Arabia, Japan, Korea, Australia, Taiwan, Thailand, Mexico, Malaysia, Indonesia, China and Vietnam attended this three-day conference. The goal of this meeting was to review the embryology and morphology of various types of VSD's, echocardiographic evaluation of VSD's, hemodynamic considerations of VSD's and the most up-to-date treatment options for VSD's focusing primarily on demonstrating and discussing transcather techniques for VSD closure.

Using the same format as last year's Congress, the meeting was a combination of large didactic sessions, smaller breakout lunch sessions and live interactive cases broadcast to the meeting site from the Nhi Dong (Children's Hospital) #1 (ND #1) and the Heart Institute catheterization laboratories. The organizing committee assembled an excellent international panel of experts in morphology, echocardiography, and interventional cardiology from Canada, Germany, India, Indonesia, Japan, Korea, Malaysia, Saudi Arabia, Taiwan, Thailand, the United Kingdom, the United States, and Vietnam. Guest operators from many of these countries worked with their Vietnamese colleagues in the two catheterization laboratories to transmit high quality live transcather cases of primarily various types of VSD's using various devices, as well as some other lesions including PDA's and ASD's.

As this was a three-day meeting with many excellent lectures and live demonstrations, for the sake of space, the authors would like to summarize the meeting by highlighting certain lectures and live cases that seemed to be more groundbreaking, novel or draw the biggest interest of the participants. The two 'pros and con' sessions will also be highlighted.

Meeting

Live Cases

Day #1: A total of 24 cases were broadcast over the three-day Congress. The morning of the first day, eight cases were broadcast. These included cases of: Transcatheter PDA Closures with the ADO II AS, and the PDA-R Devices, a Transcatheter ASD Closure with the Flex II Device and Stenting of a Coarctation in a 67-year old. The case that drew the most participant's interest was the coarctation stenting, and there was lively debate about the need for cerebral CT or MRI imaging for long standing coarctation to rule out Berry aneurysms. The afternoon cases included: two coronary fistulae and one ASD with malalignment, and suspected PAPVR (just discussing Echo).

Day #2: On the second day of the Congress, eight cases were completed and included many types of VSDs. The most interesting case that sparked the most discussion was an infundibular VSD closure.

Day #3: On the final day of the Congress, seven cases were performed, and the case that proved to be the most interesting was a Post-MI VSD closure.

Didatic Meeting

Day #1: The morning session of the first day of the Congress started with introductions and a welcome by Dr. Vu Minh Phuc, President of the Ho Chi Minh City Pediatric Cardiology and Congenital Heart Disease Society. This was followed by a thought-provoking opening presentation by Dr. Lee Benson on "Interventions in Congenital and Structural Heart Disease: Who Drives New Techniques and Devices." The first morning session chaired by Drs. Benson, Qureshi and Gala focused on transcather pulmonary interventions. This session included lectures on "Transcather Pulmonary Valve Implantation: Who, When and How?" by Dr. Qureshi (UK), "RVOT Stenting: Who, When and How?" by Dr. Benson (Canada), "Stenting Peripheral Pulmonary Arteries: Who, When and How?" by Dr. Choi (Korea), and "Pulmonary Atresia with Intact IVS: Which Procedure is Reasonable?" by Dr. Al-Mutairi (Saudi Arabia). Dr. Benson's presentation on RVOT stenting in TOF proved to spark the most discussion with his assertion that a new approach to stenting neonatal RVOT may provide superior results as compared to BT shunts or early repairs.

The second morning session was dedicated to Aortic Interventions. "Coarctation: Covered Stent or Bare Stent--When and How?" was presented by Dr. Goh (Australia), "Intervention of Aortic Valve Stenosis: Tips and Tricks" by Dr. Rasha Ammar (Egypt), "Transcatheter Aortic Valve Implantation – When and How?" by Dr. Horst Sievert (Germany), and "Perventricular Aortic Valve Implantation with Jenavalve" by Dr. Hans Reiner Figulla (Germany).

Lunch breakout sessions consisted of the two major topics. The first was "Pulmonary Hypertension: Basic Science and Advanced Therapies" with presentations on diagnosis and new treatment modalities by Drs. Roymanee (Thailand), Vinh (Vietnam), Akagi (Japan), Wang (Taiwan) and Culbertson (USA). The parallel lunch session was "Imaging Diagnosis: Fetus Echo" with excellent imaging lectures provided by Drs. Latiff (Malaysia), Benson (Canada) and Tuyen (Vietnam). As in the previous Congress, the lunchtime sessions proved to be the most stimulating for closer interactions between participants and faculty in a smaller venue.

The afternoon session was chaired by Drs. Wilson, Amin and De Giovanni and

concentrated on Fistula Interventions. This included lectures on "Transcatheter Closure of Portal-Systemic Fistula" by Dr. Tin (Vietnam), "Coronary Fistula Closure: Tips and Tricks" by Jae Young Choi (Korean), "Pulmonary AV Fistula Closure: Tips and Tricks" by Dr. Carlos Zabal (Mexico), "Paravalvular Leak--Tips and Tricks" by Dr. Joseph De Giovanni (UK), and "Necessary Tools for Fistula Occlusion" by Dr. Worakan Promphan (Thailand).

The first evening social event included: a classic Vietnamese water puppet show followed by a buffet dinner and cruise down the Saigon River which provided beautiful views of Ho Chi Minh City at night.

Day #2: The first morning session chaired by Drs. Qureshi, Wilson and De Giovanni concentrated on "Basic Considerations of VSD's" and included lectures on: "Embryology of Ventricular Septum" by Dr. Hidehiko Hara (Japan), "Morphology of VSD's" by Dr. Toshio Nakanishi (Japan), "Hemodynamic Changes in Different Types of VSD" by Dr. Lee Benson (Canada) and "Echocardiography in Evaluation of VSD's" by Dr. Nina Wunderlich (Germany).

The second morning session (again chaired by Drs. Quershi, Wilson and De Giovanni) was the always entertaining and enlightening "Pro and Con" Sessions. It started with presentations on "Natural History of VSD in South East Asia" by Dr. Thanarat (Thailand) and "Why I Do Surgical Closure for VSD in Vietnam" by Dr. Nguyen Vien (Vietnam). This set the stage for the first "Pro and Con" debate "All VSD's Should be Closed Irrespective of Size." The "Pro" argument was presented by Dr. Sukman Putra (Indonesia) who argued that we should close all VSD, even the small ones, because of the risk of endocarditis in developing countries. The "Con" debate was presented by Dr. Akagi Teiji (Japan) who countered with the argument that endocarditis is not a big problem compared with potential complications in transcatheter closure. In the end, the participants sided with Dr Teiji.

The second "Pro / Con" debate focused on "Closure of Small VSD's: Device Better than Surgery?" Dr. Bharat Dalvi (India) presented an overwhelming case that devices in small VSD's were better than surgery, and although Dr. Sivakumar Sivalingam (Malaysia) did an expert job to argue the contrary opinion (complete with ten excellent references from the literature), the participants overwhelmingly agreed with Dr. Dalvi.

The breakout lunch sessions on Day #2 of the Congress concentrated on two topics: "Diagnostic and Interventional Imaging" with presentations by Drs. Nakanish (Japan), Wunderlich (Germany), Latiff (Malaysia) and Amin (USA). The parallel lunch session, "VSD Closures Around the World," featured presentations from Drs. Dalvi (India), Hieu (Vietnam), Durongpisitkul (Thailand), Indriwanto (Indonesia). Samion (Malaysia), and Kong (China).

The afternoon session, "Special Considerations in VSD Closure," was chaired by Drs. Benson, Amin and Galal, and included presentations on "Transcatheter Closure in Post-Infarction VSD's" by Dr. Giovanni, "Transcather Closure in Post-Endocarditis VSD's" by Dr. Galal, "Transcatheter Closure in Residual VSD's" by Dr. Wilson, and the most provocative presentation of the afternoon, "Perventricular VSD Closure: Coming of Age," by Dr. Amin. His presentation certainly 'ignited' the participants to consider 'hybrid' or alternative means of closing difficult VSD's between surgery and the cath lab.

The final session of the day, "Special Considerations in VSD Closure (Part 2)," included Dr. Amin's presentation on "Perimembranous VSD Closure by Device-What are the Requisites?" "Transcather Closure in Infundibular VSD," by Dr. Trong-Phi Le (Germany), "Transcatheter Closure of Muscular VSD's" by Dr. Dalvi (India), and "How to Deal with Swiss Cheese VSD's" by Dr. Schneider (Germany).

That evening, the Gala dinner was presented at the Sheraton Saigon Hotel and Tower for all participants. It was a delicious affair of multiple courses of excellent Vietnamese cuisine and concurrent Vietnamese entertainment – including a beautiful singing performance by Dr. Tuong, one of the cardiologists at Nhi Dong #1.

Day #3: The final day morning session was chaired by Drs. Qureshi, Wilson and Dalvi, and focused on "Techniques in VSD Closure." There were four presentations: "Procedure Steps in Transcather VSD Closure" (Dr. Qureshi), "Device Selection for VSD Closure" (Dr. Dalvi), "Ante- and Retrograde Approach in VSD Closure" (Dr. Rao) and "Femoral or Jugular Route: When and How" (Dr. Wilson). The morning session continued with the theme of "Different Devices – Same Issue?" and focused on specific devices. Dr. Amin focused on VSD Closure with the MEVSD 2, Dr. Kozlik on VSD Closure with the Pfm Coil, Dr. Hieu on VSD Closure with ADO I, Dr. Djer on VSD Closure with ADO II, Dr. Yi on VSD Closure with Lifetech Device, and Dr. Lertsapcharoen on VSD closure with the Cocoon Device.

There were two breakout lunch sessions. The first concentrated on special considerations in the Cardiac ICU which dealt with issues related to VSD Closure (Pulmonary Hypertension, Low Cardiac Output, Arrhythmias Ventilator Issues and Pulmonary Function). The other breakout lunch session, which was quite popular, had the topic of "Special Cases," which included: "My AV Block Case," "My Most Interesting Case," "My Most Challenging Case," "My Nightmare Case," "My Mystery Case," and "My Depicting Complications."

The first of the final afternoon sessions chaired by Drs. Benson and De Giovanni dealt with the important topic of "Complications and Failures" and included presentations on: "AV Block: What's the True Incidence? What's the Risk Factor?" (Dr. De Giovanni), "Residual Shunting: When and How Important?" (Dr. Qureshi), "Embolization of Device: How to Deal with Them?" (Dr. Dalvi), "Influence of Device on Aortic and Tricuspid Valve" (Dr. Hieu). The second of the final topics was "Follow-up in VSD Closure" and included presentations by Dr. Benson, "Problems on Mid- and Long-Term Follow-up," Dr. Wunderlich, "Echocardiography for Follow-up VSD Closure: What to Look for?" Dr. Wilson, "Late AV Block: Predictable or Unpredictable?" and Dr. Galal, "The Different Devices Used for VSD Closure."

The following day both the faculty and participants were taken on an extensive tour of the Mekong Delta in South Vietnam.

Summary

The organizers and Course Directors of "VSD 2013" would like to thank all the participants who came to the VSD Congress in HCMC, as well as the international faculty who added immeasurably to the learning experience of the participants. The organizers would also like to recognize and thank all the industry exhibitors and sponsors who made this Congress a success. We hope that all the participants also enjoyed the Vietnamese cultural activities and tours that were a part of this Congress.

Future

The organizers of "VSD 2013" hope you will join them again in HCMC, January 8-10, 2014 for the *4th Vietnam Congress of Congenital and Structural Heart Disease "Fistula from A to Z"*. For more information, visit the HCMC Pediatric Cardiology and Congenital Heart Disease Society website www.congenitalheartdisease.net.vn or contact Dr. Do Tin via email at: drdotin@congenitalheartdisease.net.vn.

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Preview - Pediatric Heart Failure Summit - October 10-12, 2013: Challenges in Advanced Heart Failure

By Jack F. Price, MD

Please join us as we explore the challenges of advanced heart failure in children at the 2013 Pediatric Heart Failure Summit. The educational event will be held in Houston, Texas, October 10th-12th on the campus of Rice University and the world-renowned Texas Medical Center. The summit is produced in partnership with SickKids Labatt Family Heart Centre in Toronto and Cincinnati Children's Heart Institute.

The organizing committee has created an outstanding curriculum featuring medical and surgical experts from leading institutions in North America and Europe. Course highlights will include:

- management of acute heart failure syndromes;
- pathophysiology and treatment of hyponatremia;
- monitoring in the ICU; acute myocarditis;
- how to restore fluid balance in the diuretic-resistant patient; strategies for preserving renal function;
- ventilatory strategies in decompensated heart failure;
- and an update on mechanical circulatory support in children.

In addition, a special session will examine the ethics of end-stage heart failure.

Lynne Warner Stevenson, MD, Director of the Heart Failure and Cardiomyopathy Program at Brigham and Women's Hospital in Boston and a world renowned expert in heart failure, will deliver the keynote address. Dr. Stevenson is Professor of Medicine at Harvard Medical School. She has served on national guideline panels for heart failure, pacing devices, patient decision-making, CMS and JCAHO standards. Her research has focused on the physiology of decompensation and re-compensation, and includes leadership roles in NHLBI-sponsored studies for strategies of medical and device therapies in advanced heart failure. Strong commitments for her remain: the tailoring of therapies to physiology and individual life journeys and training for the next generation to sustain both new discovery and the still-unparalleled privilege of caring for patients.

The summit will be held at the BioScience Research Collaborative (BRC) building on the campus of Rice University, directly across from the Texas Medical Center and the conference hotel. The BRC is a state-of-the-art venue with wireless internet capability, electrical outlets at the seat of each attendee and comfortable surroundings.

A variety of educational methods will be employed at the conference including: lectures, case presentation, question and answer, and panel discussion. The target audience includes pediatric cardiologists, intensivists, neonatologists, emergency department physicians and other physicians interested in the management of advanced heart failure in children.

The organizing committee has planned several lectures addressing some of the fundamental concepts of advanced heart failure. These lectures are highlighted as "Mechanisms of Disease" topics and include: "The Neurohormonal Storm of Advanced Heart Failure" by Dr. Michael Burch, London; "The CardioPulmonary Interaction" by Dr. Ronald Bronicki, Houston; "Left Ventricular Noncompaction Cardiomyopathy" by Dr. Jeffrey Towbin, Cincinnati; and "Acute Kidney Injury in Decompensated Heart Failure" by Dr. Stuart Goldstein, Cincinnati.

On Thursday, October 10th, Part 1 of a 2-part session on acute heart failure syndromes in children will be co-moderated by Dr. Dan Penny, Houston and Dr. Michael Burch, London. This session will address several topics related to advanced heart failure with an emphasis on clinical decision making. Dr. Melvin Almodovar, Boston, will discuss which data may help us to manage our patients with decompensated heart failure. Dr. Paolo Rusconi, Miami, will speak on biomarker-guided heart failure therapy and whether a laboratory-driven practice can make a difference in outcomes. Dr. Thomas Mir, Hamburg, Germany, will describe the co-morbidity of anemia in heart failure and help us to better understand the clinical and therapeutic implications. The final speaker for this session will be Dr. Charles Canter, Director of Heart Failure and Transplant Services at St. Louis Children's Hospital. Dr. Canter will update conference attendees on acute myocarditis in children.

Part 2 of the session on acute heart failure syndromes is scheduled for Friday, October 11th and will focus on optimizing treatment. It will be moderated by Dr. Steven Schwartz, Toronto, and Dr. Anthony Chang, Orange County. Dr. Antonio Cabrera, Houston, will lead off this session with recommendations and insight on managing acute heart failure syndromes in the pediatric emergency department. Dr. Joseph Rossano, Philadelphia, will describe the therapeutic targets and goals for treating children with decompensated heart failure. A lecture by Dr. Jeffrey Kim, Houston, will shed light on patient selection and timing of cardiac resynchronization in heart failure. Finally, Dr. Robert Shaddy, Chief of Cardiology at Children's Hospital of Philadelphia, will address the difficult issue of reducing the hospital readmission rate of heart failure patients.

A session on the respiratory system and its impact on heart failure will occur Thursday, October 10th, and will be moderated by Dr. Jeff Dreyer, Houston and Dr. John Lynn Jefferies, Cincinnati. Dr. Lara Shekerdemian, Chief of Critical Care Medicine at Texas Children's Hospital, will discuss ventilatory strategies in children with decompensated heart failure. Dr. Steven Schwartz, Toronto, will illuminate the complexities of pulmonary hypertension in advanced heart failure. A lecture on airway management and use of anesthetic agents in acute heart failure will be delivered by Dr. Dean Andropoulos, Chief of Anesthesiology at Texas Children's Hospital, Houston. Dr. Douglas Bradley, Chair of Sleep Apnea and Respiratory Research at Toronto Rehabilitation Institute will describe the comorbidity of sleep disordered breathing and its impact on heart failure.

In the afternoon of Friday, October 11th, a session on the renal system will be moderated by Dr. Michael Burch, London, and Dr. Seema Mital, Toronto. This session will focus on acute and chronic kidney injury in heart failure patients and strategies for decongesting and preserving renal function. Dr. Ayse Arikan, Houston, will describe how to restore fluid balance in the volume overloaded patient and address the issue of diuretic-resistance. Renal biomarkers will be discussed by Dr. Michael Zappitelli, Montreal, as well as how to measure kidney function in heart failure. Dr. John Lynn Jefferies, Cincinnati, will speak on the use of

ultrafiltration in the volume-overloaded heart failure patient and provide an update for its use in pediatrics. Finally, Dr. Michael Moritz, Pittsburgh, will address the complicated issue of hyponatremia in heart failure—why it occurs and how it can be treated.

On Friday afternoon, October 11th, a very special session on the ethics of end-stage heart failure will be moderated by Dr. Timothy Hoffman, Columbus. This session will consist of a clinical case scenario of a 14 year-old boy with Duchenne muscular dystrophy and the treatment options available for him. Dr. Clifford Chin, Cincinnati, will describe the benefits of cardiac transplantation in this patient. Dr. David Morales, Cincinnati, will detail why a left ventricular assist device is optimal therapy in this scenario. Dr. Hugh Allen, Houston, will discuss optimization of medical therapy alone. Following the clinical case arguments, Dr. Jeff Dreyer, Houston, will address the issue of LVAD destination therapy and whether a role exists for such technology in the treatment of children. Dr. Roxanne Hirsch will conclude the session with a lecture on the ethics of end-stage heart failure and when quality of life conflicts with reasonable therapy. This session is sure to bring out healthy discussion from the attendees and panelists.

Also on Friday afternoon, a special session on clinical science will be moderated by Dr. Jeffrey Towbin, Cincinnati. This session will feature Dr. Anthony Chang, Chief of Cardiology at Children's Hospital of Orange County. He will discuss big data in pediatric cardiology and how it will revolutionize our understanding of medicine. Dr. Xander Wehrens, Director of the Cardiovascular Research Institute, will address new therapeutic targets for heart failure. Dr. Seema Mital, Toronto, will speak on personalized approaches to treatment of pediatric heart failure.

Finally, on Friday, October 11th, Dr. Lynne Warner Stevenson, Director of Heart Failure and Cardiomyopathy at Brigham and Women's Hospital in Boston and professor of medicine at Harvard Medical School, will deliver our summit keynote address. Dr. Stevenson is renowned for her contributions to the field of heart failure as well as for her teaching skills with students, trainees and physician/nurse learners.

Two sessions on Saturday, October 12th will focus on mechanical circulatory support in children with heart failure. Dr. Charles Fraser, Chief of Surgery at Texas Children's Hospital, and Dr. Charles Canter, St. Louis, will moderate the first session which highlights clinical solutions through mechanical support. Dr. Dean McKenzie, Houston, will give an overview of the use of ventricular assist devices in pediatrics in the United States. Dr. David Rosenthal, Director of Pediatric Heart Failure at Stanford University, will describe the utility of VAD and cardiac databases in children and how they might aid in decision making. Candidacy for VAD implantation will be presented by Dr. Christopher Almond, Boston, with a focus on risk stratification prior to surgery. Dr. Aamir Jeewa, Houston, will speak on the outpatient management of VAD supported pediatric patients and Dr. Susan Denfield will give insight on the role of echocardiography after implantation.

The second VAD session will focus on technology and innovation. Dr. O.H. Frazier, Director and Chief of the Center for Cardiac Support at St. Luke's Hospital, Houston, will describe recent advances in the total artificial heart. John Bartos of Cameron, Houston, will speak on the collaborative efforts between the oil industry and medicine in VAD innovation. The miniature devices will be described by Dr. William Cohn, Houston, and Dr. Iki Adachi, Houston, will help us understand which short-term device is optimal in pediatric acute heart failure.

At the conclusion of the summit, attendees should be able to: identify and implement evidence-based strategies for managing the diuretic-resistant patient with heart failure; identify patients at risk of developing hyponatremia during heart failure treatment and implement appropriate therapies to reverse the electrolyte derangement; counsel family members regarding palliative care for their child with end-stage heart failure; identify the risk factors, prognostic implications, and treatment options for anemia in patients with heart failure.

Baylor College of Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians and designates this live activity for a maximum of 15.5 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity. The session, Ethics and End-stage Heart Failure, has been designated by Baylor College of Medicine for 1.75 credits of education in medical ethics and/or professional responsibility. Targeted physician learners were surveyed several months ago to identify heart failure practice gaps and barriers to clinical implementation. The planning committee then analyzed the data to determine the underlying educational needs related to the gaps and used this information to develop the CME activity to focus on the needs.

Rooms have been reserved at a special discounted rate for summit attendees at the Marriott Medical Center Hotel, conveniently located across the street from the conference location. Please use the group code TTRTTRA when reserving your accommodation. Rooms will also be available at Hotel ZaZa, across from Hermann Park. Shuttle service will be provided to and from the conference site for attendees staying at Hotel ZaZa.

Immediately preceding the *Pediatric Heart Failure Summit 2013*, Texas Children's Hospital will host the *Berlin Heart User's Training Seminar*. The seminar is not part of the symposium, and will not be designated for physician credit. The seminar will focus on the following topics:

- Use of Berlin Heart EXCOR Pediatric VAD
- Pre-implant decisions
- Implant strategies
- Post-implant management
- Anticoagulation
- Hands-on system use
- Wet lab with implant demonstrations

A special welcome reception for attendees will be held on the evening of October 10th at the Armadillo Palace. Live music, hot food, and cold drinks will be provided along with hotel shuttle service.

Please visit the summit website for registration (www.texaschildrens.org/phfs2013). Registration fees are $495 for physicians and $395 for nurses, residents/fellows, and other health care professionals. If you plan to register on-site, contact the Office of Continuing Medical Education at least 24 hours in advance to confirm activity status and space availability. The OCME reserves the right to limit the number of participants in an activity, and will not be responsible for any expenses incurred by an individual whose registration is not confirmed and for whom space is not available.

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New Initiative Could Help Improve Surgical Outcomes in Children, Study Suggests

Newswise — A group of pediatric surgeons at hospitals around the country have designed a system to collect and analyze data on surgical outcomes in children – the National Surgical Quality Improvement Program (NSQIP) is the first national database able to reliably compare outcomes among different hospitals where children's surgery is performed. The effort could dramatically improve surgical outcomes in children, say the initiative's leaders, who published their findings online August 5, 2013 in the journal, *Pediatrics*.

The model is based on a similar effort adopted nationwide nearly a decade ago for adult surgery that resulted in reduced mortality and dramatic decreases in post-surgical complications. These efforts, led by the American College of Surgeons (ACS), are being driven not by a federal mandate, but by a desire to improve patient care, says R. Lawrence Moss, MD, corresponding author of this new study and Surgeon-in-Chief at Nationwide Children's Hospital.

"The real impetus is that people want their patients to do better," said Dr. Moss, who has been involved with the initiative since its inception. "This was a surgeon-directed effort and the ultimate goal is to improve quality of patient care."

The ACS NSQIP-Pediatric began as a pilot in 2008 with four hospitals. The program now has 43 participating institutions that perform children's surgery. The August study is the third published by the group and details how a new statistical model designed specifically for children can be used to reliably discriminate performance among hospitals.

Historically, US hospitals didn't track this kind of information in children or adults, because there was simply no way to collect, analyze and interpret the data in a way that made sense. For example, comparing outcomes of bypass surgery in a cardiac unit at an urban facility performing thousands of the procedures per year to those of an under-staffed rural hospital that rarely does the operation would be comparing apples to oranges, Dr. Moss said. A key component of NSQIP is its ability to accurately adjust outcomes for patient risk factors. This means NSQIP is able to compare hospital performance even when the institutions see different patient populations.

When the ACS implemented its model for measuring surgical outcomes in adult surgery in 2004, it quickly became clear that, while that system would be useful in an adult setting, it couldn't be used by pediatric surgeons. Not only does the adult model include surgeries that aren't performed in children, but the range of post-

surgical complications is also different, Dr. Moss, said. Adults often suffer complications as a result of diabetes, smoking-related respiratory problems or coronary disease – comorbidities a surgeon wouldn't often see in a pediatric patient. Pediatric patients are more affected by congenital abnormalities and comorbidities specifically related to the diagnosis for which they are having surgery.

Procedures, comorbidities and potential complications are more specific to the pediatric population in the new model. In addition, this new program focuses more on morbidity as a measure of surgical outcomes, rather than mortality, which Dr. Moss said better encompasses the specific nature of pediatric surgery.

"Furthermore, creating a 'risk-adjusted' model allows pediatric surgeons to avoid the apples-to-oranges comparison," Dr. Moss said. Such elements as surgical caseload, complexity of cases, patient demographics and other categories are factored into a highly precise algorithm. The resulting model allows a children's surgical department in a small-town hospital to meaningfully compare its outcomes with a large institution such as Nationwide Children's.

"In the unique world of children's surgery, we can now accurately obtain and share risk-adjusted outcomes in a way that will allow institutions to take actions that are going to improve patient care," said Dr. Moss, who also is the E. Thomas Boles Jr., Professor of Surgery at The Ohio State University College of Medicine.

Participating institutions employ a full-time surgical clinical reviewer who collects data in nearly 100 different categories, ranging from patient demographics to specific post-surgical complications patients experience within 30 days of surgery. Each institution submits its data, then receives a report that shows how they rank in the different categories. These rankings are blind, in that the only institution named in a report is the one receiving the report.

In the *Pediatrics* study, the new model was used to analyze data on 46,281 patients under the age of 18 who underwent surgery at 43 participating institutions in 2011. It's a proof-of-concept that the model works, said Jacqueline M. Saito, MD, MSCI, Assistant Professor of Surgery at Washington University and St. Louis Children's Hospital.

"An important milestone for the program is the ability to analyze hospital performance in multiple outcomes and by surgical specialty," said Dr. Saito, who is the lead author of the study. "Hospitals with below expected performance may use the information yielded from this analysis to improve surgical outcomes locally. Eventually, best practice guidelines will be developed using processes from hospitals with better than expected outcomes."

Now that the model has been tested, the ACS is inviting other institutions to join. The ACS program for adult surgery has hundreds of participating hospitals, and Dr. Moss predicts the pediatric program will also see a surge in participation. To share best practices, those institutions that have the best outcomes will be asked to share details of their programs at the ACS annual meeting.

For more information on the American College of Surgeons National Surgical Quality Improvement Program-Pediatric, visit http://www.pediatric.acsnsqip.org/.

Ketamine as Anesthetics Can Damage Children's Learning and Memory Ability

Recent studies have found that anesthesia drugs have neurotoxicity on the developing neurons, causing learning and memory disorders and behavioral abnormalities. Ketamine is commonly used in pediatric anesthesia. A clinical retrospective study found that children below 3 years old who receive a long-time surgery, or because of surgery require ketamine repeatedly will exhibit the performance of school-age learning and memory disorders and behavioral abnormalities. The research group speculates that these abnormalities may be related to the potential neurotoxicity of ketamine. A recent study published in the *Neural Regeneration Research* (Vol. 8, No. 17, 2013) showed that ketamine could induce tau phosphorylation and neuronal toxicity in the development of neurons detected using molecular biology techniques from aspects of gene and protein levels. The relevant findings suggest that ketamine induces tau hyperphosphorylation at serine 404, resulting in damage to microtubule and axonal transport. Such damage may cause neurotoxicity and neuronal death in neonatal rats, consistent with previous studies demonstrating ketamine-induced neuronal apoptosis.

Article: "Ketamine induces tau hyperphosphorylation at serine 404 in the hippocampus of neonatal rats " by Haiyan Jin1, Zhiyong Hu1, Mengjie Dong2, Yidong Wu3, Zhirui Zhu1, Lili Xu4 (1 Department of Anesthesiology, The Children's Hospital, School of Medicine, Key Laboratory of Reproductive Genetics, Ministry of Education, Zhejiang University, Hangzhou 310003, Zhejiang Province, China; 2 PET Center, The First Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou 310003, Zhejiang Province, China; 3 Department of Central Laboratory, The Children's Hospital, School of Medicine, Key Laboratory of Reproductive Genetics, Ministry of Education, Zhejiang University, Hangzhou 310003, Zhejiang Province, China; 4 Department of Anesthesiology, The Second Affiliated Hospital of Zhejiang Chinese Medical University, Hangzhou 310005, Zhejiang Province, China).

Jin HY, Hu ZY, Dong MJ, Wu YD, Zhu ZR, Xu LL. Ketamine induces tau hyperphosphorylation at serine 404 in the hippocampus of neonatal rats. Neural Regen Res. 2013;8(17):1590-1596.

Vanderbilt Heart Performs First US Implantation of Fully Resorbable Antibacterial Envelope for Cardiac Devices

Newswise — Vanderbilt Heart and Vascular Institute is the first medical center in the United States to use a new fully resorbable "envelope" that encloses implantable cardiac devices, such as pacemakers and internal cardioverter defibrillators (ICDs), and helps prevent surgical site infections.

The AIGISRx R Antibacterial Envelope from TYRX, Inc. received US Food and Drug Administration clearance on May 20th, 2013.

AIGISRx R Antibacterial Envelope is a fully bioresorbable, antibacterial pouch-like mesh envelope that holds cardiac rhythm devices securely in

place when implanted in the body. The envelope contains the antimicrobial agents rifampin and minocycline, which are released locally into the tissue, to help reduce infections associated with cardiac implantable electronic devices (CIEDs).

"Over the last several decades, the number of cardiac device infections has risen significantly and out of proportion to the number of cardiac device implantations. With more than 500,000 CIED implantations annually in the US, it is critical that the infections associated with these types of procedures are avoided to help save lives and money," according to cardiologist Christopher Ellis, MD, Assistant Professor of Medicine, who used the resorbable envelope for the first time on Aug. 7th.

The CIED is placed below the collar bone in a pocket the physician creates underneath the skin. Once the device is placed inside the mesh envelope and implanted into the pocket, the antimicrobials are released and the envelope dissolves entirely within about nine weeks.

"The infection protection is still there. It's nice to know when I go back into the pocket several years from now, I won't even know it (AIGISRx R) was ever in there," Ellis said.

Research by Ellis and colleagues at Vanderbilt has shown that the AIGISRx Antibacterial Envelope significantly reduced device infections by nearly 90% in high-risk patients, compared to patients who did not receive the AIGISRx.

Nationally, patients with surgical site infections following CIED procedures spend additional time in the hospital and undergo repeat surgical procedures to treat the infection. These patients experience significant increases in morbidity and mortality, with one-year mortality rates of greater than 25%, and three-year mortality of up to 50%, depending on device type.

Cardiac device generators typically need to be replaced every five to eight years due to wear and tear, and each time the procedure is performed, the rate of infection increases exponentially, Ellis said. In addition, there are some patients who are at greater risk of infection due to diabetes, kidney disease and prior device infection.

No Benefit Associated with Echocardiographic Screening in the General Population

A study in Norway suggests echocardiographic screening in the general public for structural and valvular heart disease was not associated with benefit for reducing the risk of death, myocardial infarction (heart attack) or stroke, according to a report published by *JAMA Internal Medicine*, a JAMA Network publication.

Because of the low prevalence of structural heart disease in the general population, echocardiography has traditionally not been considered justified in low-risk individuals, although echocardiography is recommended for screening asymptomatic individuals with a family history of sudden death or hereditary diseases affecting the heart, according to the study background.

Haakon Lindekleiv, MD, PhD, of the University of Tromsø, Norway, and colleagues examined whether echocardiographic screening in the general population improved long-term survival or reduced the risk of cardiovascular disease in a randomized clinical study.

Researchers studied 6,861 middle-aged participants (3,272 in a screening group and 3,589 in a control group). In the screening group, 290 participants (8.9%) underwent follow-up examinations because of abnormal findings and cardiac or valvular pathologic conditions were verified in 249 participants (7.6%).

"Among the screening group, the prevalence of structural heart and valvular disease was 7.6%, and the most common finding was valvular disease. However, diagnosing asymptomatic disease is useful only if it can lead to clinical action that slows or stops progression of disease. Although sclerosis of the aortic and mitral valves has been associated with a substantial increased risk of cardiovascular disease, we did not find that early diagnosis of valvular disease in the general population translated into reduced risk of death or cardiovascular events," the study notes.

During 15 years of follow-up, 880 people (26.9%) in the screening group died and 989 people (27.6%) in the control group died. No significant differences were found in the measures for sudden death, mortality from heart disease, or incidence of fatal or nonfatal myocardial infarction and stroke, according to the results.

OCTOBER MEETING FOCUS

Pediatrics 2040: Trends & Innovations for the Next 25 Years
Oct. 3 - 5, 2013; Anaheim, CA USA
www.choc.org/pediatrics2040/

Overview: Focus on the emerging medical and technological advances as well as trends in the care of children for the next 25 years. Specific subject areas covered include: AI, Genomic Medicine, Pediatric Nanomedicine, Robotics and Robotic Surgery, Medical Devices and Mobile Technology, Regenerative Medicine and Stem Cells, Innovations in Healthcare Delivery, and Big Data

Planning Committee: Anthony C. Chang, MD, MBA, MPH; Nick Anas, MD; James D. Korb, MD; Harry Pellman, MD; Sharief Taraman, MD

Keynote Speakers: Daniel Kraft, MD, PhD; Edward H. Shortliffe, MD, PhD, MACP, FACMI; Paul H. Wise, MD, MPH. **Scheduled Speakers:** Jack Andraka - Innovator; Winner of the 2012 Intel International Science & Engineering Fair; Greg Auner, BS, MS, PhD; Ralph Clayman, MD; Daniel Cooper, MD; Kimberly Cripe - President & CEO, CHOC Children's; Jennifer Shine Dyer, MD, MPH; William W. Feaster, MD, MBA; Gabor Forgacs, PhD; Naomi Fried, PhD; Chih-Ming Ho, PhD; Mustafa Kabeer, MD; Jeffrey M. Karp, PhD; Joe Kiani - Founder, Chairman & CEO, Masimo Corp.; Jason M. Knight, MD; Donald Lombardi - CEO, Institute for Pediatric Innovation; Chris Longhurst, MD; William G. Loudon, MD, PhD; Paul S. Lubinsky, MD; Kevin Maher, MD; Maria Minon, MD; Spyro Mousses, PhD; Diane J. Nugent, MD; Kerri Schiller - Senior VP & CFO CHOC Children's Hospital; Phillip Schwartz, PhD; Leonard S. Sender, MD; Nigam Shah, MBBS, PhD; Wendy Sue L. Swanson, MD, MBE, FAAP; Randall C. Wetzel, MB, BS, MRCP, LRCS,FAAP, FCCM; Neda Zadeh, MD

Selected Presentations:

- Innovations in Pediatric Medicine
- Open Access and Disruptive Innovations in Medicine
- Trends in Electronic Health Records and the Future of eHealth
- Pediatric Nanomedicine
- Robotics and Robotic Surgery
- Genomic Medicine
- Personalized Genomic Medicine in Children
- Laboratory Testing on a Chip
- Regenerative Medicine and Stem Cells
- Summit: Children's Hospitals and Pediatric Subspecialties in 2040
- AI: From the Present to the Future
- Using Big Data to Shift Pediatric Care from Evidence-Based Practice to Practice-Based Evidence
- Data-Driven Medicine in the Age of Electronic Health Records
- And many more....

"This supports existing guidelines that echocardiography is not recommended for cardiovascular risk assessment in asymptomatic adults," the study concludes. "Although our results were negative, we believe that they are of clinical importance because they may contribute to reducing the overuse of echocardiography."

Correction - August Issue

Congenital Cardiology Today misspelled "Ebstein" (as Epstein) in the title of the August issue - Volume 11; Issue 8 of the lead article, "Recurrent Hemoptysis in a 30-Year-Old Female with Ebstein's Anomaly and a Prior History Epicardial ICD Patches: Status Post Orthotopic Heart Transplant" By Tabitha Moe, MD; Andrew Kao, MD; Anthony Magalski, MD.

Our mistake was corrected in the PDF version of the issue in both the North American and International editions. You may view it at: www.CongenitalCardiologyToday.com

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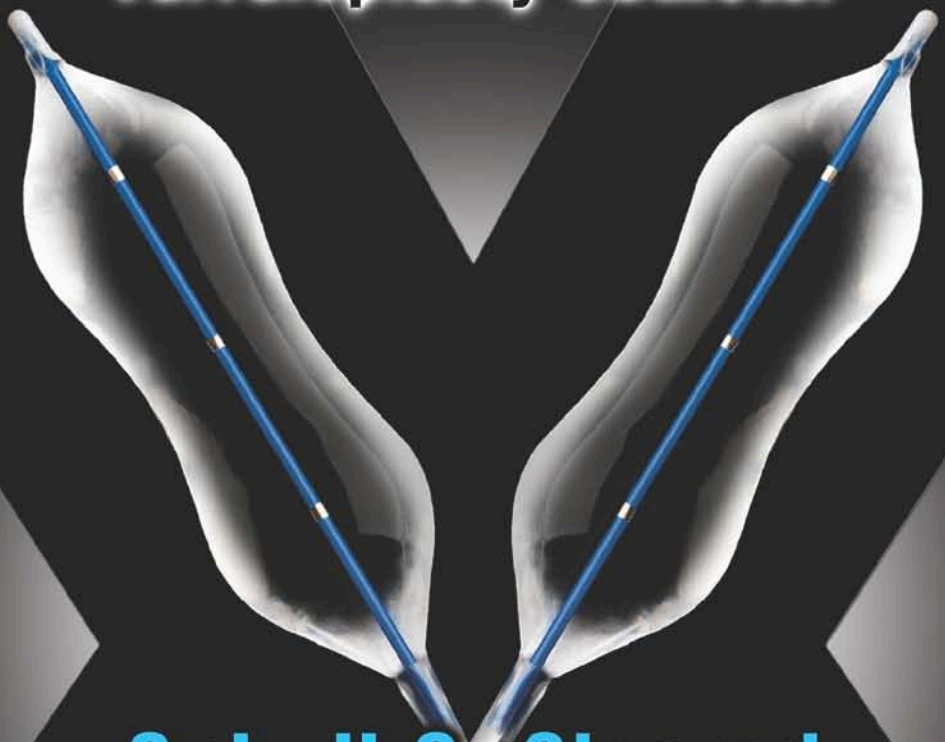

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