Effect of Different Modes of Chest Physiotherapy on Arterial Blood Gases Following Paediatric Cardiac Surgery

By Md. Abu Shaphe, PT, PhD; Rajeev Aggrawal, MPT, (PhD); Mohd Abid Geelani, MCH; Jamal Ali Moiz, MPT

Abstract

Background

Lung complications after pediatric heart surgery frequently include atelectasis and pneumonia. Physiotherapy has an important role in the treatment of these complications. This study was designed to compare changes in Oxygenation index (PaO$_2$/FiO$_2$) and PaCO$_2$ caused by different modes of chest physiotherapy in ventilated pediatric patients after cardiac surgery.

Methods

Pediatric patients who were ventilated after cardiac surgery were randomly assigned to one of three modes of CPT (chest physiotherapy) based on clinical evidence of tracheobronchial secretion retention. Oxygenation index and PaCO$_2$ were measured before CPT and fifteen minutes after completion of the CPT sessions up to three days after surgery.

Results

All three modes of CPT resulted in improvement of oxygenation of infants. No modes of CPT were demonstrated superior to the others in terms of improvements in Oxygenation index or PaCO$_2$.

“Lung complications after pediatric heart surgery frequently include atelectasis and pneumonia. Physiotherapy has an important role in the treatment of these complications. This study was designed to compare changes in Oxygenation index (PaO$_2$/FiO$_2$) and PaCO$_2$ caused by different modes of chest physiotherapy in ventilated pediatric patients after cardiac surgery.”
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The present data suggest all three CPT modes were found to be effective in improving oxygenation of infants following cardiac surgeries in ICU while on ventilation. However, none of the three CPT modes were superior over other.

Introduction

Children with congenital heart disease often develop changes in respiratory mechanics. In addition, heart surgery associated with cardiopulmonary bypass (CPB) also leads to a number of respiratory complications. Thus, CPT in the post-operative period has as main objectives lung re-expansion, airway clearance, and prevention of complications such as pneumonia.

CPT plays an important role in the prevention and management of lung complications. A large number of studies have reported the effects of CPT on this patient population. Authors have used a variety of strategies, techniques, and duration of treatment. Moreover, different approaches and combinations have been employed without specific scientific rationale. The purpose of this study was to evaluate the impact of three different CPT modes on Oxygenation index and PaCO2 in ventilated pediatric patients after cardiac surgery.

Methods

The study was performed in the G. B. Pant Hospital New Delhi, India. It included 45 ventilated pediatric patients, age range 12-72 months (mean 36.75 months), following open heart surgery. Informed consent was obtained from the parents of the subjects.

Inclusion Criteria

- Children up to 6 years of age.
- Had undergone corrective cardiac surgery.
- Subjects while on mechanical ventilation.
- Clinical evidence of tracheobronchial secretion retention.

Exclusion Criteria

- Cardiovascular unstable subjects.
- Neurologically ill patients.

Patients returning to the cardiac intensive care unit were ventilated using an endotracheal tube attached to a servo ventilator, with humidification at 34°C from a respiratory humidifier. Based on the Inclusion and Exclusion Criteria, eligible patients were randomly assigned to one of three CPT modes designated groups A, B, and C using a chit method.

- Group A: (n=15) Percussion and Suctioning.
- Group B: (n=15) Vibration, Bag squeezing and Suctioning.
- Group C: (n=15) Percussion, Vibration, Position change, Bag squeezing and Suctioning.

Figure 1. Comparison of PaO2/FiO2 pre- and post-CPT of day 1 among groups.

For more information or to apply for this position, please contact:
Robert Mangano, MD, c/o Kathy Kardisco, Department of Professional Staffing, at 1-800-845-7112, email: kkardisco@geisinger.edu.

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Saint Louis University, a Catholic, Jesuit institution dedicated to student learning, research, health care, and service is seeking additional pediatric cardiologists to join an established group within the Division of Cardiology and the Department of Pediatrics at Cardinal Glennon Children’s Medical Center. Applicants will be considered at the Assistant/Associate Professor rank, and must be board certified/eligible in Pediatric Cardiology. General responsibilities will include clinical care, teaching, and research.

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Interested candidates must submit a cover letter, application, and current CV to http://jobs.slu.edu. Other correspondence regarding this position can be sent to:

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Results

Group Analysis

Group A: (Percussion and Suctioning): On day 1st pre- and post-CPT, PaO2/FiO2 changes were non-significant (p=0.975). On day 2 in the morning, PaO2/FiO2 fall to 221.68 ± 26.15 from 236.07 ± 26.55 which was statically significant (p=0.007). On day 2 in the evening, there was significant improvement in PaO2/FiO2 following percussion and suctioning (p=0.008). PaCO2 On day 1 pre- and post-CPT changes were non significant (p=0.199). On day 2 in the morning, PaCO2 fall to 37.67±2.47 from 38.51±3.90 which was non-significant (p=0.238). On day 2 in the evening PaCO2 improved towards normal (p=0.007).

Group B: (Vibration, Bag Squeezing and Suctioning): On day 1 pre- and post-CPT, PaO2/FiO2 change was non-significant (p=0.137). There was no difference in PaO2/FiO2 on post-op day 2 morning when compared with post-op day 1 evening value (p=0.586). On day 2 in the evening, PaO2/FiO2 improved significantly (p=0.007). PaCO2 On day 1st pre- and post-CPT changes were non-significant (p=0.325). On day 2 in the morning, PaCO2 improved towards normal which was significant (p=0.001). On day 2 in the evening, PaCO2 again improved towards normal which was significant (p=0.30).
Humanitarian Device. Authorized by Federal law (USA) for use in pediatric and adult patients with a regurgitant or stenotic Right Ventricular Outflow Tract (RVOT) conduit (≥ 16 mm in diameter when originally implanted). The effectiveness of this device for this use has not been demonstrated.
Group C: (Percussion, Vibration, Position change, Bagsqueezing and Suctioning). On day 1 pre- and post-CPT, PaO2/FiO2 changes were non-significant (p=0.080). On day 2 in the morning, PaO2/FiO2 changes were non-significant (p=0.217). On day 2 in the evening, PaO2/FiO2 improved to 254.86 ± 38.25 which was statically significant (p=0.000). PaCO2. On day 1 pre- and post-CPT changes were significant (p=0.018). On day 2 in the morning, PaCO2 changes were non-significant (p=0.995). On day 2 in the evening, PaCO2 improved towards normal 39.67 ± 2.35 which was statically non-significant (p=0.347).

"Inter" Group Analysis: There were no significant differences between the study groups in PaO2/FiO2 or in PaCO2 at any of the time points evaluated.

Figure 2. Comparison of PaCO2 pre- and post-CPT of day 2 among groups.

Figure 3. Comparison of PaO2/FiO2 post-CPT of 1st day evening and post-CPT of 2nd day evening among groups.

Academic Title: Assistant or Associate Professor - Medical Director of Cardiac Transplantation

Description: THE UNIVERSITY OF CALIFORNIA, SAN DIEGO, DEPARTMENT OF PEDIATRICS (http://www-pediatrics.ucsd.edu) AND CHILDREN’S SPECIALISTS OF SAN DIEGO (http://childrensspecialists.com) are committed to academic excellent and diversity within the faculty, staff, and student body and are jointly recruiting a Medical Director of Cardiac Transplantation for the unified Division of Pediatric Cardiology at Rady Children’s Hospital, San Diego. This 220-bed facility serves as a major regional tertiary care hospital for children and is the major teaching facility for the Department of Pediatrics of the UCSD School of Medicine.

The Director position is a unique opportunity to develop an exceptional Cardiac Transplantation Program in San Diego. The successful candidate must have training and experience in a UNOS certified pediatric cardiac transplant center and should possess the qualifications for academic appointment at the rank of Assistant or Associate Professor. The academic series will be determined based on the background and qualifications of the successful candidates. Candidates must be Board Certified in Pediatric Cardiology and licensed or licensable to practice medicine in the State of California. This appointment will require demonstrated administrative capabilities, excellent skills in clinical care and teaching, and research accomplishment.

The Division provides a full range of Pediatric Cardiology services. It currently has six pediatric cardiologists, two cardiothoracic surgeons, and an ACGME approved fellowship program. The Division supports a program with approximately 400 surgical procedures yearly. Extensive opportunities to perform clinical, epidemiologic or basic science research exist at UCSD and Children’s Hospital, San Diego.

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or by e-mail to:
John Moore, M.D.
jmoore@rchsd.org

or by mail to:
3020 Children’s Way, MC 5004
San Diego, CA 92123

Salary commensurate with qualifications and based on University of California pay scales.

Closing Date: Applications received by December 17, 2011 or until the position is filled, will receive full consideration.

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San Diego, CA 92123
Discussion

This study shows that at no time during treatment was any group superior to the others in terms of PaO$_2$/FiO$_2$ and PaCO$_2$. PaO$_2$/FiO$_2$ showed no improvement following CPT on day 1 in all three groups. In group A, only percussion was given before suctioning, whereas in group B, vibration and bag squeezing were given before suctioning. These two techniques were found to be equally effective. The combination of both techniques in group C, i.e. percussion, vibration, position change, bag squeezing and suctioning, did not show any additional benefit over the any of the single technique. In this group of patients, no patients had severely deteriorated changes in ABG before the study and could not show dramatic change following various combinations of techniques. Earlier studies showed, that CPT is of no value and has a negative effect in patients without many secretions.8,9,10

In group A, PaO$_2$/FiO$_2$ did not show any change in the evening following CPT. It may be therefore, that pre-CPT, the PaO$_2$/FiO$_2$ were not deranged. So with percussion and routine suctioning, PaO$_2$/FiO$_2$ was maintained until evening. But, because there was no percussion given in the night, second day morning PaO$_2$/FiO$_2$ dropped significantly.

Oxygenation of arterial blood is studied as the ratio of the partial pressure of arterial oxygen to the fraction of inspired oxygen (PaO$_2$/FiO$_2$). This is done to control for supplemental oxygen given to patients in critical care settings. The ratio of (PaO$_2$/FiO$_2$) is an indirect measure of oxygen content in the arterial blood and is representative of optimal gas exchange in the acini. A decrease in ratio of PaO$_2$/FiO$_2$ indicated that less oxygen is available for tissue metabolism which can further lead to acidosis and multiple organ system failure. A decrease in PaO$_2$/FiO$_2$ can occur in mechanically ventilated patients as a consequence of pulmonary complications like atelectasis, retained secretions and ventilator associated bacterial colonization. Retained secretions increase dead space ventilation and act as a diffusion barrier to gas exchange. The oxygen transport is more adversely affected due to its slower diffusion rate rate which leads to a gross V/Q mismatch and decrease in PaO$_2$/FiO$_2$ levels.
In the evening of day 2, there was significant improvement in PaO2/FiO2 following percussion and suctioning which shows the need for CPT in pediatric patients following cardiac surgery. Other literature has also reported the use of chest percussion in improving oxygenation. Finner & Boyad (1978) reported the improvement in arterial oxygenation in the neonate following percussion using a contact heel technique. However, Hussey et al (1996) were unable to show any improvement in oxygenation, Connors et al (1980) found a negative correlation between the amounts of secretions and arterial oxygen level. Hussey et al (1976) showed a decrease in PaO2. In another study by Wollmer et al (1985), no significant difference in oxygen saturation between pre- and post-treatment was seen. Gallon (1991) reported sputum production was significantly greater when percussion was included in the treatment regimen.

In group B, vibration and bag squeezing did not show any additional benefit, the results were the same as group A. PaO2/FiO2 did not show any significant change in the evening following CPT. Again, there was no difference in PaO2/FiO2 in post-op day 2 morning when compared with the post-op day 1 evening. Holody & Goldberg (1981) showed a significant increase in PO2 at 30 min and 1 hour after completion of chest vibration, and said chest vibration is a useful therapeutic modality in the management of hypoxemia in patients with atelectasis or pneumonia. Fox et al (1978) reported mean PO2 decreased significantly after suctioning and increased significantly after hyperventilation. Goronezano and Branthwaite (1972) studied three different groups. Although treatment was similar in all groups, significant changes in PaO2 were largely confined to patients in group 2 who were all suffering from serious cardiac pathology.

In group C, the treatment techniques applied were: percussion, vibration, position change, bag squeezing and suctioning, PaO2/FiO2 shows non-significant changes on the day one following above the technique. On day 2 evening PaO2/FiO2 improved significantly following CPT. The results of this group were similar to groups A and B, which shows there is no difference following different techniques of chest physiotherapy in pediatric age group. Tudehope and Baglay (1980) show an increase in PaO2 with a mean rise of 16.6 mmHg following CPT. Even Mackenzie et al (1978) showed improvement in PaO2/FiO2 after CPT, though the results were statically insignificant. It was found that the arterial oxygenation improved significantly after initiation of CPT. Interestingly, there was a decline in the levels of PaO2/FiO2 between the evening values of day 1 and the morning values of day 2. This implies that receiving no CPT during the night adversely affects the level of oxygenation in mechanically ventilated patients. It is conceivable that patients accumulate secretions in the lungs during the the no CPT periods leading to drops in the arterial oxygenation as more secretions accumulate. Instead the the sentence ending with renowned. Zack M B (1974) showed that PaO2 was generally higher in the right lateral decubitus position than in the left, although the difference was not significant. Suctioning induced hypoxemia is frequently reported in the literature. But we were able to abolish it by giving 5-6 breaths of increased oxygenation before and between suction. Finally, this corroborates with Kareem et al (1990).

In this study groups A, B and C show non-significant changes in the partial pressure of carbon dioxide level following CPT. This is primarily because most of the patients had no CO2 retention even prior to CPT initiation. This could be because of the nature of their pulmonary complications which include tachypnea initially, and thus removal of excess CO2. Furthermore, as the PaCO2 in arterial blood is an indirect measure of dissolved CO2 in arterial blood, the levels are affected by minute ventilation. As the respiratory rate or tidal volume increases, the minute volume also increases, thus removing excess carbon dioxide. Therefore, the lack of any changes in PaCO2 in these patients pre- versus post-CPT can be attributed to the modification of respiration rate and tidal volume by the ventilator settings. Finner & Boyad (1978) also reported that there is no significant change in PaCO2.
Further research with longer follow-up periods and larger populations is required for generalization of these results regarding chest physiotherapy in children.

References

“So, it can be concluded that young children need chest mobilization along with suctioning at regular intervals to avoid hypoxemia and carbon dioxide fluctuation after cardiac surgery.”
18. Gormezanol J and Branthwaite MA. Effects of physiotherapy during intermittent positive pressure ventilation. Anesthesia. 1972(b); 27: 258-263.

Table 5: Comparison of PaCO₂ of Pre- and Post-CPT on 2nd Day Among Groups

<table>
<thead>
<tr>
<th>GROUP A</th>
<th>GROUP B</th>
<th>GROUP C</th>
<th>F</th>
<th>P</th>
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<tbody>
<tr>
<td>n=15</td>
<td>n=15</td>
<td>n=15</td>
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<tr>
<td>M± SD</td>
<td>M± SD</td>
<td>M± SD</td>
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<tr>
<td>Pre-CPT</td>
<td>37.67±2.47</td>
<td>37.00±2.41</td>
<td>38.50±3.67</td>
<td>1.005</td>
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<tr>
<td>Post-CPT</td>
<td>39.92±3.91</td>
<td>38.98±2.04</td>
<td>39.67±2.35</td>
<td>0.420</td>
</tr>
<tr>
<td>t</td>
<td>3.193</td>
<td>2.417</td>
<td>0.973</td>
<td></td>
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<tr>
<td>p</td>
<td>0.007</td>
<td>0.30</td>
<td>0.347</td>
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Table 6: Comparison of PaCO₂ Post-CPT on 1st Day Evening and Post-CPT on 2nd Day Among Groups (S=Significant; NS=Non-Significant)

<table>
<thead>
<tr>
<th>GROUP A</th>
<th>GROUP B</th>
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<tbody>
<tr>
<td>n=15</td>
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<td>M± SD</td>
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</tr>
<tr>
<td>1st Day Post-CPT</td>
<td>38.51±3.90</td>
<td>40.09±3.22</td>
<td>38.50±1.91</td>
<td>1.291</td>
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<tr>
<td>2nd Day Post-CPT</td>
<td>39.92±3.91</td>
<td>38.98±2.04</td>
<td>39.67±2.35</td>
<td>0.420</td>
</tr>
<tr>
<td>t</td>
<td>1.644</td>
<td>1.091</td>
<td>1.437</td>
<td></td>
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<tr>
<td>p</td>
<td>0.238</td>
<td>0.001</td>
<td>0.995</td>
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SCAI’s CHD Council Offers Online Bibliography for Quick Reference

By Eric Grammer

SCAI’s CHD Council has created an online bibliography of critical publications for congenital interventionalists that is now available online at www.scai.org/CHD/Bibliography.aspx.

Plan to Celebrate 35 Years of the Best in Interventional Education at SCAI 2012

Start planning now to join your colleagues in celebrating 35 Years of the Best in Interventional Cardiology Education at SCAI 2012 Scientific Sessions in Las Vegas, May 9-12, 2012. Being organized by Symposium Chair Daniel S. Levi, MD, FSCAI and Symposium Co-chair Thomas E. Fagan, MD, FSCAI the Congenital Heart Disease Symposium at SCAI 2012 is starting to take shape.

The CHD Symposium will feature three days of uninterrupted, focused programming on interventional therapies for congenital and structural heart disease in children and adults. Headlining the program, Julio, C. Palmaz, MD will be delivering the Mullins Keynote Lecture. The inventor of the first commercially-successful intravascular stent, Dr. Palmaz’s keynote will focus on the history and future of stent technology.

With a focus on case-based learning, SCAI’s uniquely collegial atmosphere provides ample opportunity to compare notes and network with a faculty of recognized leaders in the field of pediatric and adult congenital/structural interventional cardiology. Here’s your chance to get involved in the programming. We need your “I Blew It” and “Brain Scratcher” case submissions. The simple concept behind both the “Brain Scratchers” and "I Blew It" Sessions is that there is no better teaching method than coming together as a community and sharing our unusual and challenging cases.

The "Brain Scratchers," Session challenges attendees to solve hemodynamic, angiographic or interventional mysteries and to provide solutions for less than routine cases in the congenital catheterization laboratory. The "I Blew It" Sessions highlight the creative ways that our colleagues manage complications.

More importantly, the session addresses how to avoid such events in the future.

If you have a case that might be a good learning tool for either session, please contact Thomas Fagan, MD, FSCAI, at fagan.thomas@tchden.org. Presentations should last no more than a total of 10 minutes including a dialogue with participants and moderators in how to deal with the complication. The presentation should conclude with some teaching points.

To download the preliminary program, learn more or register for SCAI 2012, please visit www.scai.org/SCAI2012.

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In addition, abstract presenters also receive free registration to SCAI 2012 and the Top 10 Abstracts are selected for oral presentations on stage during the sessions. Submission is free and easy, but the December 16th deadline will be here before you know it. Submit your abstracts at www.scai.org/SCAI2012Abstracts.

“SCAI’s CHD Council has created an online bibliography of critical publications for congenital interventionalists that is now available online at www.scai.org/CHD/Bibliography.aspx.”

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CONGENITAL CARDIOLOGY TODAY • www.CongenitalCardiologyToday.com • November 2011 11
Every 15 minutes in hospitals across America, a baby is born with a congenital heart defect (CHD), or a malformation of the heart’s structure and function. Thanks to the advances in modern medicine, more than 80% of these babies are surviving into adulthood and living healthy and productive lives. The children and adults living with CHDs still face unique health challenges requiring specialized life-long care.

A recent briefing on Capitol Hill sponsored by the American Academy of Pediatrics and co-sponsored by the American College of Cardiology (ACC) and other leading cardiovascular societies and patient advocacy groups, highlighted the important role of federal and state programs in CHD research, surveillance, screening and prevention. Senators Richard Durbin (D-IL) and Thad Cochran (R-Miss.), co-hosted the event, Congenital Heart Defects: A Lifelong Disease.

Panelist Geoffrey Rosenthal, MD, PhD, FACC, Professor of Pediatrics at the University of Maryland School of Medicine, said CHD places an undeniable burden on the public health system, as well as families. The Congenital Heart Futures Act, passed into law as part of the 2010 health reform legislation, would establish a national surveillance program for CHD patients and serve as a step in the right direction to reduce this burden, he asserted.

Rosenthal also pointed to new activities related to research, care, surveillance and policy development, including the Congenital Heart Public Health Consortium (CHPHC), of which the ACC is a member. The Consortium looks to prevent, enhance and prolong the lives of those with CHD through public health activities, including health promotion and education. Additionally, national CHD registries and other CHD collaborative quality improvement and multi-center research activities will continue to advance the care and management of the tiniest heart patients, who are destined to need life-long specialized heart care. Ultimately there is still more work to be done, Rosenthal maintains. “We need to expand birth defect monitoring programs, reduce disparities and plan for adequate health services,” he said. “How do we save those who are still dying? Physicians and the federal government have a critical role to play moving forward.”

The federal government took a huge step towards improving early detection for CHD patients this week. Health and Human Services (HHS) Secretary Kathleen Sebelius announced that all U.S. hospitals will be required to screen newborns for CHD using pulse oximetry. The Secretary’s Advisory Committee for Heritable Disorders in Newborns and Children had recommended adding pulse oximetry, an inexpensive and non-invasive test to the universal screening panel – a move the ACC and other professional societies and patient advocates in the CHD community have endorsed.

For more on the ACC’s involvement in CHD, visit the Adult Congenital and Pediatric Cardiology (ACPC) member section on CardioSource.org. The ACPC Section has played a major role in strengthening educational programming for congenital cardiology care providers and has several

**Update in Congenital Heart Management**

*Immediately preceding the World Congress of Cardiology*

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For more information contact Alan Weisman at aweisman@childrensnational.org or call +1-202-476-2728

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**Congenital Cardiac Intensivist**

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Interested candidates are encouraged to submit their curriculum vitae to:

Janet Simsic, MD
Director of the Cardiothoracic Intensive Care Unit
Nationwide Children’s Hospital
T2296, 700 Children’s Drive
Columbus, OH 43205
or janet.simsic@nationwidechildrens.org

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For more information contact Alan Weisman at aweisman@childrensnational.org or call +1-202-476-2728
significant accomplishments in science and quality, including the development of the IMPACT Registry™ (IMproving Pediatric and Adult Congenital Treatment), which tracks diagnostic and interventional cardiac catheterization in pediatric and congenital heart disease patients. In addition, the ICD Registry™ (Implantable Cardioverter Defibrillator) now includes data elements specific to the pediatric population.

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Researchers Develop New Way to Predict Heart Transplant Survival

Johns Hopkins researchers say they have developed a formula to predict which heart transplant patients are at greatest risk of death in the year following their surgeries, information that could help medical teams figure out who would benefit most from the small number of available organs.

"Donor hearts are a limited resource," says John V. Conte, MD, Professor of Surgery at the Johns Hopkins University School of Medicine and the senior author of the study. "Now, we have a simple-to-use tool that is highly predictive of survival after a heart transplant, and can help guide organ allocation decisions."

Conte and his colleagues, writing in the September issue of Annals of Thoracic Surgery, pulled together a series of risk factors already associated with poor outcomes, such as age, race, gender, the cause of a patient's heart failure and whether he or she was on dialysis, and then assigned a number of points to each factor. The sum of those points created a score. The higher the score, the higher the risk of death one year after transplant.

Some factors were weighted more heavily than others, such as female gender (three points); African-American race (three points), and the need for dialysis in the time between being put on the transplant waiting list and getting a transplant (five points).

Patients with the lowest scores — between zero and two — had a 92.5% chance of being alive 12 months after surgery.

Patients with so-called IMPACT scores — the acronym the researchers came up with for the Index for Mortality Prediction After Cardiac Transplantation — above 20 points had a less than 50% chance of survival one year after surgery. Every point on the scale increased the chance of death within one year by 14%.

To develop and test the validity of IMPACT, Conte and his team analyzed data provided by the United Network of Organ Sharing comprising information from all heart transplants — 21,378 of them — conducted in the United States between 1987 and 2010.

More research is needed to learn what role is played by factors other than the recipient's risks, Conte says. Results of their study suggest, for example, that an organ coming from a donor over the age of 50 or one that has been outside the body for more than four hours also increases the risk of death in the recipient, he says.

More than 3,000 people are on the waiting list for a heart transplant in the United States, and many will die before they can get a new heart. Only about 2,000 heart transplants are performed in the US annually. Currently, determining who gets an available heart takes into account how long a patient has been on the list and how sick they are. There is

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The Children’s Heart Group at the Penn State Hershey Children’s Hospital

CHIEF, DIVISION OF PEDIATRIC CARDIOLOGY

The Children’s Heart Group of the Penn State Hershey Children’s Hospital is seeking a dynamic Chief of the Division of Pediatric Cardiology to lead our cardiovascular program.

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Candidates should have demonstrated a high level of administrative and clinical competence, and be able to provide vision and direction for the clinical, training and research missions of the division. Applicants for this position should be board certified in Pediatrics and Pediatric Cardiology and will be eligible for appointment at the rank of Associate Professor or Professor.

Qualified candidates should forward their curriculum vitae to:

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Research opportunities are therefore related to, but not exclusive of, the departments of biomechanics, artificial organs, and nanotechnology at the Penn State University. In addition, the Penn State College of Medicine has a vibrant development program that affords junior faculty the opportunity to advance their knowledge in epidemiology and clinical research.

Those interested should forward their curriculum vitae to:

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Commonly Used Defibrillators Raise Risk of Problems

When it comes to defibrillators, simpler may be safer, even though more complex machines are used on a majority of patients.

That’s according to a new study from a team that included University of Colorado School of Medicine researcher Paul Varosy, MD. The team reviewed more than 100,000 records of cardiac patients. They found that there was more chance of surgical problems and death with devices that require electrical leads to be attached to two chambers of the heart compared to those that work on one chamber.

Although there are potential theoretical benefits, the higher-risk complex defibrillators have never been shown to result in improved survival or decreased rates of hospitalization, says Varosy, Assistant Professor of Medicine at the medical school.

“There is no reason for alarm, and it’s important to remember that defibrillators of all kinds have clearly-established benefits in terms of reducing mortality among patients at risk for sudden cardiac death,” Varosy says. “But this study does suggest that the simpler defibrillators may cause fewer short-term problems, suggesting that the routine use of dual-chamber defibrillators even in the absence of a simultaneous need for a pacemaker should be re-evaluated.”

The two-chamber defibrillator is used in about six of 10 surgeries, according to Varosy, Director of Cardiac Electrophysiology at the VA Eastern Colorado Health Care System. The study was published in the Journal of the American College of Cardiology. It examined 104,000 records of cardiac cases from 2006-07.

Impact of Clinical and Echocardiographic Response to Cardiac Resynchronization Therapy

The Echocardiographic Response (reduction of left ventricular end-systolic volume) evaluated at 6 months follow-up, demonstrated to be a better predictor of long-term mortality than improvement in clinical status in a large population of CRT patients. Therefore, assessment of occurrence of left ventricular reverse remodeling at mid-term follow-up may be an adequate surrogate end point in heart failure patients treated with CRT.

The efficacy of Cardiac Resynchronization Therapy (CRT) has been demonstrated with significant reductions in mortality and morbidity of
heart failure patients. However, many studies have evaluated the efficacy of CRT by means of improvement in heart failure symptoms (clinical response) or reduction in left ventricular volumes (left ventricular reverse remodeling) and improvement in left ventricular function (echocardiographic response) at mid-term follow-up (3 or 6 months after CRT implantation). Based on these surrogate end points, the efficacy of CRT may change significantly and, consequentially, definition of response to CRT is still debated. Ideally, these surrogate end points should determine a significant reduction in mortality. Accordingly, the present evaluation investigated which definition of CRT response at mid-term follow-up (clinical improvement or left ventricular reverse remodeling) best predicts long-term mortality. A total of 663 advanced heart failure patients were followed-up for the occurrence of all-cause mortality. At 6 months follow-up, the clinical and echocardiographic responses to CRT were evaluated. Clinical response to CRT was defined as a reduction in New York Heart Association functional class of at least 1 point whereas echocardiographic response to CRT was defined by a reduction in left ventricular end-systolic volume of at least 15%. Based on these definitions, 510 (77%) patients showed clinical response and 412 (62%) patients showed echocardiographic response to CRT. During a mean follow-up of 37±22 months, 140 (21%) patients died.

Clinical and echocardiographic CRT responses were both significantly related to all-cause mortality. However, only echocardiographic response to CRT was independently associated with a superior survival. In particular, a patient who did not show echocardiographic response had a risk of death three times higher than a patient showing a good echocardiographic response (hazard ratio 0.38; 95% confidence intervals, 0.27-0.50; p<0.001).

A cumulative 1%, 4% and 8% of the patients with LV reverse remodeling died by 12, 24 and 36 months follow-up, respectively. In contrast, a respective 8%, 19% and 27% of the patients without LV reverse remodeling died during the same time period (log-rank p <0.001).

The present findings have important implications in the design process of clinical trials, since the use of biological markers in the prevention and progression of heart failure (such as changes in left ventricular volumes and function) allows investigators to make a prompt evaluation of heart failure therapies and helps to understand the biologic processes underlying the disease and the mechanisms of the therapy. In addition, the use of these surrogate endpoints permits smaller sample size, shorter trial duration and reduced costs.

In conclusion, the echocardiographic response (reduction of left ventricular end-systolic volume) evaluated at 6 months follow-up demonstrated to be a better predictor of long-term mortality than improvement in clinical status in a large population of CRT patients. Therefore, assessment of occurrence of left ventricular reverse remodeling at mid-term follow-up may be an adequate surrogate end point in heart failure patients treated with CRT.

iApp Paed ECG: Paediatric ECG Manual

Available for both iPhone and iPad, the Paed ECG App has become an invaluable tool to all health care professionals involved in the recording or reading of paediatric electrocardiograms. A comprehensive manual of Paediatric Electrocardiography designed and developed by Dr. Marion Tipple, Paediatric Cardiologist/Electrophysiologist at the British Columbia Children’s Hospital in Vancouver, Canada, is written in straight-forward bullet style and divided into sections for ease of use. The extensive ECG database contains tracings of high resolution from pre-term infants to young adults. Criteria and examples for the different age group norms are included along with those of pre- and post-operative congenital and acquired heart disease.

The sections are organized as:
1) Basics: electrode placements, recording and lead explanation;
2) Normal: tables of normal values and variants;
3) Abnormal: recording errors, morphology, cardiac malposition, congenital heart disease (pre and post op), syndromes, acquired heart disease , system disorders;
4) Rhythm: normal and abnormal (diagrams of arrhythmia mechanisms, diagnostic criteria, differential diagnosis), inherited disorders (LQTS, Brugada, CPVT, ARVD), basic pacemaker interpretation and troubleshooting.
5) ECG Quiz: 100 tracings for self assessment.

The App has been designed for rapid access to information in busy working environments.

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 STUDY EXAMINES RISK OF AORTIC COMPLICATIONS AMONG PATIENTS WITH COMMON CONGENITAL HEART VALVE DEFECT

While the incidence of the life-threatening condition of aortic dissection is significantly higher than in the general population, it remains low among patients with the congenital heart defect, bicuspid aortic valve; however, the incidence of aortic aneurysms is significantly high, according to a study in the September 14th issue of JAMA.

Bicuspid aortic valve (BAV; defect of the aortic valve that results in the formation of two flaps that open and close, instead of the normal three) is the most common congenital heart defect, with the most serious complication from this condition (due to the high risk of death) being aortic dissection (a tear involving the layers of the wall of the aorta). "...it is estimated that BAV is responsible for more deaths than all other congenital heart defects combined. Consequently, carriers live under the threat of sudden death," according to background information in the article. However, long-term, population-based data are lacking on the incidence of severe aortic complications among patients with BAV.

Hector I. Michelena, MD of the Mayo Clinic, Rochester, MN, and colleagues conducted a study to determine the incidence of aortic complications among patients with BAV and in the general BAV population. The researchers analyzed long-term follow-up data of residents in Olmsted County, Minn., diagnosed with BAV by echocardiography from 1980 to 1999 and searched for aortic complications of patients whose bicuspid valves had gone undiagnosed. The last year of follow-up was 2008-2009. The study included 416 patients with BAV, with average follow-up of 16 years.

Over the study period, aortic dissection occurred in 2 of the 416 patients and the 25-year cohort risk of aortic dissection after echocardiographic diagnosis was 0.5%. In a comparison of incident rates, patients with BAV had a 8.4 times increased risk of aortic dissection compared with the county's general population, however, the absolute risk remained low. "The low aortic dissection incidence and lack of association with a detectable reduction in survival is reassuring," the authors write.

Of 384 patients without aortic aneurysms at the beginning of the study, 49 developed aneurysms at follow-up. The 25-year risk of aneurysm formation among BAV patients was 26%. Analysis of incidence rates indicated these patients had a 86 times higher risk of aneurysm formation compared with the general population. After aneurysm diagnosis, the 15-year risks of aortic surgery and aortic dissection were 46% and 7%, respectively. The 25-year risk of aortic surgery after BAV diagnosis was 25%.

The researchers also found that the dissection incidence was higher in patients older than 50 years and higher in those with baseline aortic aneurysms, "highlighting the importance of close monitoring and current guideline implementation in these subgroups."

Also, patients with BAV had a 25-year risk of valve replacement of 53%. "Our study confirms that aortic valve replacement remains the most common complication of patients with BAV. This highlights the importance of early recognition of BAV by careful cardiac auscultation [listening for sounds made by internal organs to aid in the diagnosis of certain disorders] in order to prevent heart failure due to late valvular surgery referrals, as well as potentially to prevent dissection by elective aorta surgical repair," the authors write.

"Research of sorts should concentrate on elucidating biological pathways of BAV aortopathy [disease of the aorta] amenable to medical treatment as well as identifying nonsize markers for refining risk prediction of aortic dissection in these patients," the researchers conclude.
Cardiovascular Implantable Electronic Device-Related Infections Linked with Increased Risk of Death

An association has been found between infection associated with cardiovascular implantable electronic devices (CIEDs) and increases in mortality and hospital care costs, according to a report published Online First by Archives of Internal Medicine, one of the JAMA/Archives journals. The article is part of the journal's Health Care Reform series.

Therapy with CIEDs, which include pacemakers, implantable cardioverter-defibrillators and cardiac resynchronization therapy/defibrillator devices, can reduce illness and death rates in appropriately selected patients, according to background information in the article. However, complications including infection may mitigate this benefit. "Although it is well recognized that the rate of CIED infection is increasing faster than the rate of CIED implantation, there are limited published data on the risk-adjusted mortality and cost associated with CIED infection or the relationship of these outcomes to different CIED types," write the authors.

Muhammad R. Sohail, MD, from the Mayo Clinic College of Medicine, Rochester, Minn., and colleagues analyzed the risk-adjusted total and incremental admission mortality, long-term mortality, admission length of stay (LOS) and admission cost associated with infection. They used data from the 100% Medicare Standard Analytic File Limited Data set version for inpatient admissions. The study group consisted of 200,219 Medicare fee-for-service patients who were admitted for CIED generator implantation, replacement or revision between January and December 2007. The researchers used the Centers for Medicare & Medicaid Services’ payment-rate calculation methods, and used factors to reflect the admitting hospital's location, teaching status and indigent care load in order to standardize charges.

Researchers found a total of 5,817 admissions with infection. Depending on the CIED type, infection was associated with significant increases in adjusted admission mortality (4.6% to 11.3%, depending on type of device) and long-term mortality (26.5% to 35.1%, depending on type of device). Approximately half of the incremental long-term mortality occurred after patients were discharged. Depending on CIED type, the adjusted LOS was significantly longer with infection. With infection, the standardized adjusted incremental and total admission costs were $14,360 to $16,498 and $28,676 to $53,349, depending on CIED type. Intensive care accounted for more than 40% of the incremental admission cost. When researchers adjusted long-term mortality rate and cost ratios with infection by CIED type, pacemakers were associated with significantly greater increases in both measures, compared with implantable cardioverter-defibrillators or cardiac resynchronization therapy/defibrillator devices.

"Our work demonstrates that Medicare beneficiary admissions for CIED procedures with infection are associated with significant, device-dependent, incremental increases in admission mortality and long-term mortality, LOS, and cost compared with those without infection," write the authors. "Intensive care and pharmacy services accounted for more than half of the incremental cost with infection and could be targeted to reduce costs associated with management of CIED infection. The etiology of excess mortality in patients with CIED infection after hospital discharge remains unclear and merits further investigation."

The Departments of Pediatrics at the University of Louisville School of Medicine and Kosair Children's Hospital are recruiting for a medical director of heart failure and cardiac transplantation for the Congenital Heart Center at Kosair Children's Hospital in Louisville, Ky.

The primary responsibilities for this position focus on directing and expanding current clinical programs in pediatric heart failure and transplantation to include collaborating with very successful clinical programs in adult heart failure, mechanical assist devices and transplantation. The Kosair Charities Pediatric Heart Research Program at the Cardiovascular Innovation Institute in Louisville and a broad array of basic science research programs at the University of Louisville provide outstanding research infrastructure and collaborative opportunities, with active programs in basic science and translational research involving tissue engineering, stem cells and ventricular assist devices.

An excellent multi-year compensation package is available, commensurate with expertise. Contact Christopher L. Johnsrude, M.D., chief of pediatric cardiology, at cjjohn02@louisville.edu or (502) 852-3876, or Amanda R. Bailey, physician recruitment manager, Norton Physician Services, at (502) 439-5144 or amanda.bailey@nortonhealthcare.org.
**Pediatric Cardiac MRI Opportunity**

The Heart Center (THC) at Nationwide Children's Hospital, pediatric teaching facility for The Ohio State University in Columbus Ohio, is recruiting an attending faculty with expertise in Pediatric Cardiac Magnetic Resonance Imaging and Noninvasive Cardiac Imaging to join its faculty. The Cardiac MRI/CT service performs over 350 studies per year, and the team includes 3 dedicated pediatric radiologists and 1 pediatric cardiologist. The NCH Echocardiography Laboratory is ICAEL accredited and the team includes 7 attending physicians and 10 sonographers. The NCH Echocardiography Laboratory performs more than 11,000 studies annually using state-of-the-art transthoracic, transesophageal, fetal, intracardiac, intravascular, strain, and 3D techniques. The program includes a 4th year Advanced Noninvasive Cardiac Imaging fellowship, in addition to pediatric and combined pediatric-adult cardiology fellowship programs. We are directly linked to our Center for Cardiovascular and Pulmonary Research, which has an NIH T-32 training grant. THC has extensive and active programs in adult congenital heart disease, hybrid strategy, cardiac intensive care, translational and outcomes research, interventional catheterization, cardiovascular surgery and outreach clinics. Current annual clinical metrics for THC includes: 450 cardiothoracic surgeries, 600 catheterizations, 10,000+ cardiology outpatient visits. The candidate would participate in programmatic growth encompassing all aspects of the Heart Center's mission including clinical service, education and research.

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Interested candidates are encouraged to submit their curriculum vitae to:

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