Issue IX | Summer 2017

Piedmont Heart Pulse

Educational News and Views

IN THIS ISSUE

Message from the Editors

Dear Colleagues,

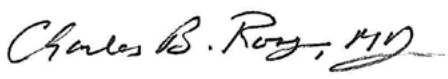
Welcome to the Summer 2017 edition of the Piedmont Heat Pulse. In the milieu of growth manifested by concrete and steel on the Piedmont Atlanta Campus as well as system growth manifested by the addition of Rockdale Medical Center, we are pleased to bring you insightful articles and news of clinical, educational and professional activities from PHI.

This edition opens with a comprehensive review of the diagnosis and management of cardiac sarcoidosis by Dr. Steve Sigman. The complementary roles of cardiac MR and FDG-PET/CT are explained.

Kathleen Turchin, BSN and Dr. Walter Mashman present a timely review of sports cardiology, representing an introduction into the emerging and complex field of exercise and sports cardiology. This article is the focus of this edition's CME activity.

The remainder of the edition offers updates from the Level I Cardiovascular Emergency Program as well as the Piedmont Atlanta Hospital PE Program. Reviews of recent PHI educational activities are included as well.

The Pulse continues to be CME accredited. We welcome your comments and contributions. Planning for the next edition is already underway. Please contact our editorial team and join our efforts to produce the next edition.



Charles B. Ross, M.D., FACS and **Joseph I. Miller**, III, M.D., FACC
Co-editors

Piedmont HEART

Cardiac Sarcoidosis: An Important Cause of Cardiomyopathy

Steven Sigman, M.D., FACC, FASNC
Director of Nuclear Cardiology,
Piedmont Hospital and
Piedmont Heart

Although less common then other causes of cardiomyopathy, cardiac sarcoidosis is an important disorder associated with high rates of morbidity and morality, including sudden cardiac death. The early recognition of this disorder can be life saving. Although generally part of a systemic process involving the lung, lymph nodes, liver, spleen, skin, and bones, pathologic studies demonstrate the infiltrative pattern of scarring and inflammation with the presence of the noncaseating granulomas in the cardiac tissue in as many as 25% of these patients. Importantly, isolated cardiac sarcoidosis, with no other manifestations of systemic disease, has also been identified in certain patients, and is generally associated with a more malignant course.

Generally presenting with symptoms typical of congestive heart failure such as dyspnea, orthopnea and swelling, cardiac sarcoidosis can also present with arrhythmic symptoms such as palpitations, syncope, or near syncope. This is due to infiltrative predilection for involvement of the cardiac conduction system. Unexplained heart block, particularly in a younger patient, is a common presentation. A high index of suspicion by the health care provider for cardiac sarcoidosis is of utmost importance.

Diagnosis

Initial identification of this disorder is generally based on ECG findings of conduction abnormalities, including right bundle branch or complete heart block, and abnormal CXR findings in the presence of new onset, unexplained congestive heart failure. A careful history - even the mildest complaint of lightheadedness on direct questioning - can be of critical importance in the identification of important arrhythmias.

Lab work may demonstrate elevation of angiotensin converting enzyme (ACE) levels as well as hypercalcemia, particularly in widely systemic disease. Non-contrast CT scanning of the chest looking for lymphadenopathy may be important. Echocardiographic findings include: reduced left and right ventricular function in the presence of multiple non-contiguous wall motion abnormalities, aneurysms, and thinning of the basal portion of the septum. Valvular abnormalities, particularly mitral and tricuspid regurgitation may be present if the infiltrative process effects the papillary muscles. Occasionally, evidence of scarring on conventional nuclear myocardial perfusion imaging studies (MPI) using technetium agents or thallium suggest the diagnosis. particularly when in distributions not typical of usual coronary artery disease.

Advanced Cardiac Imaging

Multimodality cardiac imaging with a team approach is the key to best diagnosis, prognosis, and management of this complex disorder, and is an example of where both cardiac magnetic resonance imaging with late gadolinium hyperenhancement (CMR) and using F-18 Fluorodeoxyglucose positron emission tomography and computerized tomography (FDG-PET/CT) can be useful, and more importantly, complementary.

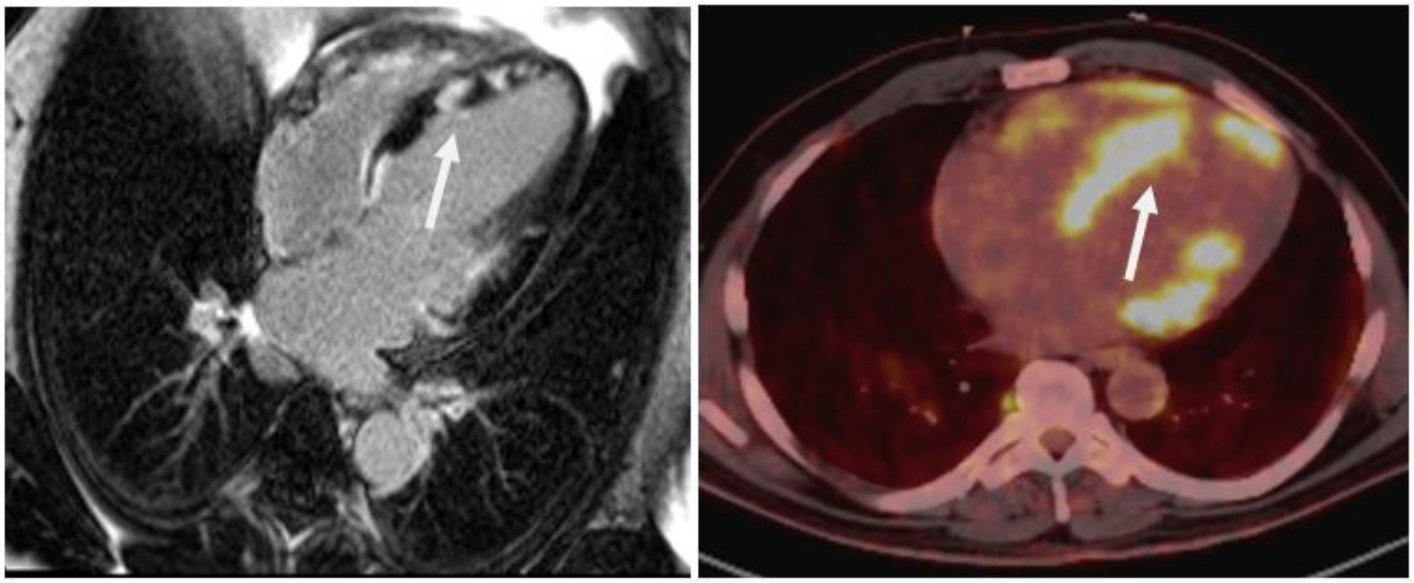
CMR

For most patients, CMR is the favored method of initial diagnosis of cardiac sarcoidosis. This is primarily due to its superior sensitivity and ability to localize even small areas of sarcoid infiltration. Typical CMR findings include dense, patchy areas of fibrosis representing scarring, particularly at the base of the anteroseptal, inferior, or inferolateral walls, which are not typical of coronary distributions. Involvement of the right ventricle has been noted as well, and when present, portends a particularly poor prognosis. CMR provides for exacting measurement of both right and left ventricular EF, as well as associated wall motion abnormalities. Degree of valvular disease can be carefully assessed as well.

FDG-PET/CT

Improvements in imaging techniques and an evolving body of research over the past few years have brought PET imaging to the forefront for both initial diagnosis and especially management of cardiac sarcoidosis. This type of imaging is based on the principle of uptake of radio labeled glucose in areas of intense inflammation characteristic of active sarcoidosis. Lack of uptake of radioisotope suggests scarring, or inactive “burnt out” disease. Performed in a manner

Figure 1: Panel A - Axial (four chamber) cardiac MRI with late gadolinium enhancement at the level of the heart demonstrating fibrosis in the mid and basal septum, base of lateral wall, and portions of the right ventricle (white areas, arrow). Panel B - Axial PET/CT scan at same level with corresponding areas of inflammation (orange areas, arrow).



A. B.

very similar that which is done for the diagnosis and management oncologic diseases, the PET image is registered to the CT image, for exacting localization. Again, akin to cancer imaging, changes in the intensity of FDG uptake, defined in terms of standard uptake values (SUV), can be used to help monitor response to treatment.

A key component to optimal performance is meticulous adherence to a pre-procedure diet high in protein and fat, and low in glucose. The resultant low glucose/low insulin milieu suppresses uptake of glucose in the normal myocardium, and enhances imaging of uptake in areas of active sarcoidosis. PET can also be the primary modality of diagnosis in patients with relative contraindications to MRI, including older model pacemakers, renal insufficiency, obesity, or claustrophobia.

A general approach to management may use both techniques: CMR to make the initial diagnosis, and PET to document an active inflammatory process as well as monitor response to therapy. Again, the important concept is that CMR and PET can be complementary *(Figure 1).*

Diagnostic Guidelines

Recent expert consensus guidelines (Heart Rhythm Society, 2014) propose the following criteria for diagnosis of cardiac sarcoidosis: (1) presence of non-caseating granulomas on histological examination of myocardial tissue by biopsy in the absence of other etiologies, or (2) a combination of positive histology from a non-cardiac source (lung biopsy*) and* either unexplained EF <40%, unexplained sustained ventricular tachycardia, Mobitz II second or third degree heart block, abnormal cardiac imaging or clinical evidence of steroid responsive improvement in CHF or heart block. However, as far as the first criterion is concerned, it should be noted that due to the patchy nature of myocardial involvement , the yield of cardiac biopsy is low (<20%).

Management

Management of cardiac sarcoidosis requires a team approach, with close cooperation among primary cardiologists, congestive heart failure

specialists, electophysiologists, radiologists, and pulmonologists experienced in the treatment and monitoring of therapy in this complex disorder.

Treatment with standard recommended therapy for CHF including beta blockers, angiotensin converting enzyme inhibitors or angiotensin receptor blockers, low dose diuretics, and aldosterone blockers, is initiated early on.

Immunosuppression with predisone is the cornerstone of treatment, usually starting with a high dose, with very slow tapering over a period of months to years. Adjunctive treatment with methotrexate may also be recommended, keeping in mind the meticulous monitoring required with use of this medication. Follow up PET FDG/CT is often repeated 6-12 months after initiation of treatment to assess response to therapy. Again emphasized is the need for careful follow up by a team well familiar with management of this disorder.

Use of Implantable Cardioverter Defibrillator (ICD)

Sudden cardiac death (SCD) is the most feared complication of cardiac sarcoidosis and with incidence 10% or higher in most series of 3-5 years episodes of prolonged ventricular tachycardia (VT) with syncope are also frequent. Further complicating the situation is that these arrhythmias can occur (and commonly do) in patients with left ventricular ejection fraction (LVEF) ranges of 35% to 50%, higher than those required for primary prevention of SCD in patient with coronary heart disease.

"Treatment of this disorder exemplifies the importance of careful collaboration between cardiologists, electrophysiologists, cardiac imagers, and pulmonologists to provide the best care possible for these complex patients."

Diagnostic Guidelines

Recent expert consensus guidelines (Heart Rhythm Society, 2014) assign a Class I indication ("is recommended") for placement of ICD in patients with cardiac sarcoidosis who have experienced sustained VT or cardiac arrest, or for patients with LVEF <35% despite optimal medical therapy and a period of immunosuppression. Class IIa ("can be useful") recommendations are made for the implantation of ICD in patients with cardiac sarcoidosis independent of LVEF if there is an indication for permanent pacemaker for heart block, unexplained syncope or near syncope, or inducible VT on electrophysiology study. The development of broader indications for placement of ICD in patients with ejection fractions between 36% to 49% is an area of strong clinical interest and research.

Prognosis

Due to the wide variability in cardiac involvement, LVEF, treatment protocol and follow up methodology, prognostic information is limited, although studies over the last 5-10 years tend to indicate a better prognosis than previously thought. One recent series of 110 patients from Finland[1] treated with immunosuppressants, contemporary treatments for CHF, and ICDs, found 97%, 90% and 83% transplant free survivals at 1,5,and 10 years, respectively.

Of note, the patients with lower EF (<35%) had worse outcomes, with a transplant free survival at 10 years as low as 53%.

Summary

Cardiac sarcoidosis is an important and perhaps underappreciated cause of cardiomyopathy, characterized by elements of congestive heart failure, as well as cardiac conduction disturbances such as complete heart block, and malignant arrhythmias including sudden cardiac death. Optimal diagnosis and treatment relies strongly on a high clinical index of suspicion. Treatment of this disorder exemplifies the importance of careful collaboration between cardiologists, electrophysiologists, cardiac imagers, and pulmonologists to provide the best care possible for these complex patients.

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Level 1 Cardiovascular Emergency Program at Piedmont Atlanta Hospital Completes Third Full Year of Operations

Grant Reynolds, BS, RN
Level I Cardiovascular Emergency System Coordinator

On June 30, 2017, the Level I Cardiovascular Emergency Program at Piedmont Atlanta Hospital celebrated its third complete year of full service operations serving the Piedmont Healthcare network, metro Atlanta and North Georgia. Recognizing the value of STEMI, stroke and trauma systems of care, the Level I program extended programmatic, time-critical care to non-coronary, non-stroke major cardiovascular emergencies including acute aortic syndromes, pulmonary embolism, acute limb ischemia, and other life and limb threatening diseases such as acute mesenteric ischemia and phlegmasia cerulean dolens. Since July 2014, the program has served 384 patients.

Acute aortic syndromes have accounted for the majority of Level I activations. These have been followed closely by submassive and massive pulmonary embolism. Acute limb ischemia and other emergencies have made up the remainder of the volume *(Figure 1).* The program has enjoyed steady growth, with referrals growing 12.7% compounded year over year.

Charles B. Ross, M.D. and W. Morris Brown, M.D. are co-medical directors of the Level I program.

Level I cardiovascular emergency programs represent a major commitment from hospitals and medical staffs, including both physicians and non-physician co-workers. These programs are receiving increasing interest as the need for multidisciplinary approaches to time-critical, non-coronary, non-stroke cardiovascular emergencies is recognized.

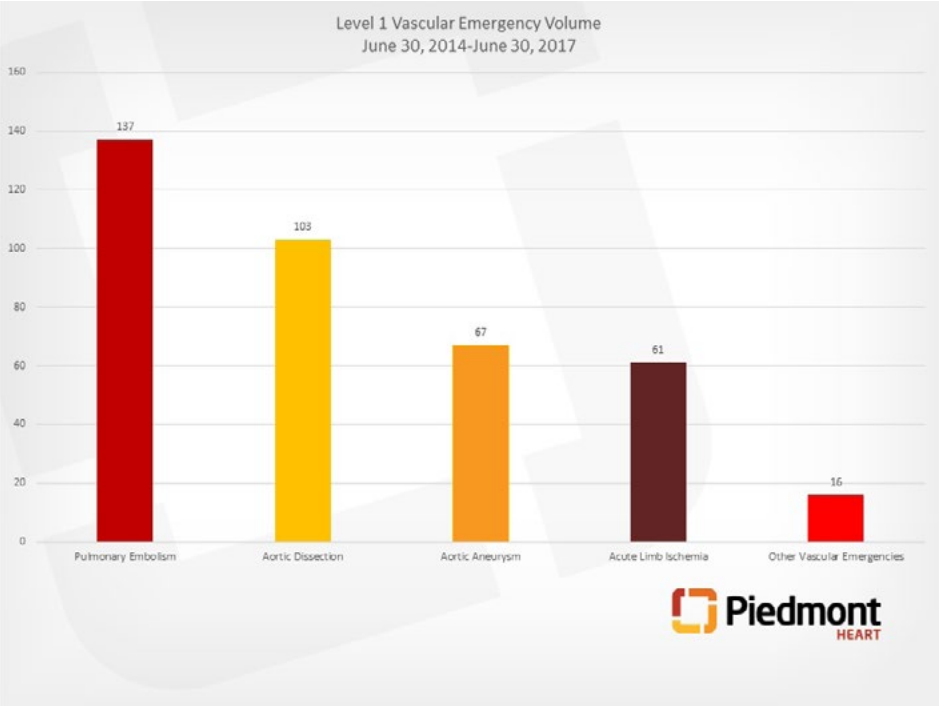

Figure 1: 36 complete months of Level I activations.

From the standpoint of major cardiovascular institutes in this country, Minneapolis Heart and Vascular Institute at Abbott Northwestern Hospital was the first center to develop a Level I program. Piedmont Heart was the second institute in the nation and the first in the southeastern United States to bring forward Level I. Academic medical centers have been led by Indiana University-Methodist Hospital in Indianapolis which runs a statewide vascular emergency network.

Central to all Level I programs are "one number-one call" access for system activation, logistical transfer support, and pre-arrival electronic transfer of imaging data.

The complete story of the Piedmont Level I Cardiovascular Emergency System, from conceptual development, infrastructural buildout, and operations was featured in the Winter 2017 edition of the *Piedmont Heart Pulse*. (Available on the *Village* intranet.)

In that article, major milestones in program development are reviewed and discussed. The build-out and continued refinement of the Level I program has served to strengthen the cardiovascular program as a whole and may serve as a resource when modeling other new initiatives.

News From the Piedmont Atlanta Pulmonary Embolism Program: Summer 2017

Charles B. Ross, M.D., FACS
Co-Medical Director,
Level I Cardiovascular Emergency Program
Chief, Vascular and Endovascular Services, Piedmont Heart

Care for patients with pulmonary embolism (PE) has continued to progress in 2017. Our program here at Piedmont Atlanta (PAH) has continued to provide leadership with activity in the areas of clinical service, research and education. An update of program activity is summarized below.

Clinical Service

The PAH Pulmonary Embolism Response Team, a component of the Level I Cardiovascular Emergency Program, has been busy in 2017. Between January 1 and June 30, there were 34 Level I activations for PE, with monthly case volume ranging from 4 to 7 *(Figure 1).* This unscheduled and oft emergent case volume represents a tremendous commitment from the PAH cath lab teams for which the Level I program and the PE interventional medical staff are most appreciative.

Data shown in the table above does not reflect total PE volume for PAH. It only reflects cases triaged to Level I activation. This explains why there is a predominance of intervention and surgery for management. Most PEs at PAH, like all centers, are minor or intermediate low-risk cases for which the PAH PERT is not routinely mobilized. Interestingly, outpatient management of minor PE is increasing in frequency.

Level I care for acute PE at PAH follows an established care plan which includes Georgia Lung Associates Pulmonary Critical Care Medicine, Kaiser Permanente Pulmonary Medicine, PHI Cardiothoracic Surgery, and the PHI PE Interventionalists (Drs. Ross, Ben Arie, Unzeitig, Klein, Kaul, and Kandzari). PE Interventional call is published as part of the PHI White Board daily. PHI Pert administration is managed by Grant Reynolds, RN, Level I Cardiovascular Emergency Program.

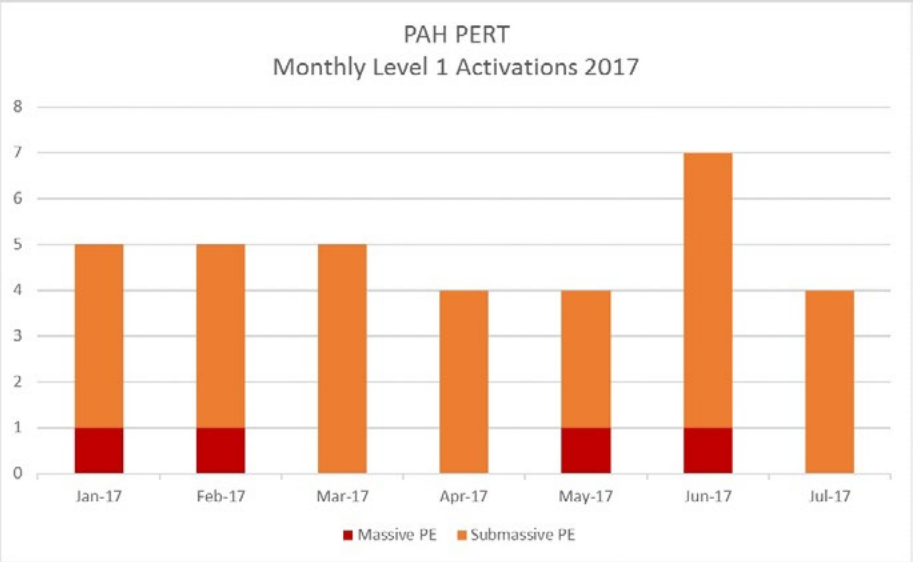

Figure 1: Over 36 months of continuous operations of the Level I program, July 2014 through June 30, 2017, there have been 134 activations of the PAH PERT for PE. This figure shows monthly activactions for the first half of 2017.

National PERT Consortium: News from the Third Annual Meeting

The PERT Consortium held its third annual meeting in Cambridge, MA on June 22, 2017. The PERT Consortium is a multidisciplinary group of healthcare professionals from 39 founding institutions and a growing list of 11 additional member institutions united in the goal to promote best practices in pulmonary embolism care. Approximately 200 professionals attended the meeting. Dr. Charles Ross, Chief of Vascular and Endovascular Services of the Piedmont Heart and Vascular Institute served on the interim board of directors of the PERT consortium 2016-2017. At this year's meeting, Dr. Ross was elected to an additional one-year term on the Board.

At the Consortium meeting, Dr. Ross served on the opening panel and described the Piedmont PERT program. Other programs highlighted were the Hospital of the University of Pennsylvania and Cedars Sinai. The consortium meeting was followed by the 3rd Annual PERT CME Symposium. The meeting was fully subscribed with

Table 2: Level I, PAH PERT PE Outcomes, July 1, 2014 – June 30, 2017

	Massive PE				Submassive PE		
Management	Total # patients	Deceased	% survival at 30-days		Total # patients	Deceased	% survival at 30-days
CDT	7	1	85.7		89	1	98.9
Medical Management	2	2	0		22	0	100
Systemic Thrombolytics	4	3	25		1	0	100
Surgical Thrombectomy	5	0	100		1	0	100
VA-ECMO	3	2	33.3		0	0	0
Total	21	8	62		113	1	99.1

Figure 2: This table depicts outcomes for massive and submassive PE patients tracked through activation of the Level I program. In the massive group, overall survival was 62%. Discounting 2 patients managed with medical, supportive care only, 13 of 19 survived (68%) survived. In the submassive PE group, the overall survival rate was 99%.
CDT = catheter-directed therapy, predominantly catheter-directed thrombolysis
VA-ECMO = venoarterial extracorporeal membrane oxygenation

over 400 attendees from the United States and 11 other countries. Dr. Andrew Klein and Dr. Charles Ross participated as faculty members for the symposium.

Kenneth Rosenfield, M.D., MHCDS, MSCAI, president of The Society For Cardiovascular Angiography and Interventions and Director of Cardiac and Vascular Invasive Services in the Division of Cardiology at Massachusetts General Hospital at Harvard Medical School deserves special recognition for development of the National PERT. Beginning circa 2012, he led a small group of dedicated physicians, interventionalists and surgeons at MGH in the formation of a pulmonary embolism response team. Dedicated to improvements in care for patients with PE, Dr. Rosenfield drove the development of the MGH PERT, generated enthusiasm for the approach, and spread the word across the country. He served as president of the PERT Consortium until this year's meeting when he moved on to development and outreach activities in an advisory capacity to the board of directors.

In his wake, Vic Tapson, M.D. of Cedars-Sinai was elected President and Richard Channick, M.D. was elected president-elect. Specialty make-up of the PERT officers and board of directors includes pulmonary-critical care medicine, vascular medicine and interventional cardiology, cardiothoracic surgery, vascular/endovascular surgery, interventional radiology, emergency medicine, and hematology. The National PERT, a truly multidisciplinary group, is now the leading force behind public awareness of PE, development of hospital and systems care for PE and clinical research in advancing care for PE. The PAH PERT team recognizes the vision and leadership provided by Dr. Rosenfield in this endeavor and will always appreciate his kindness in recognizing and encouraging our program here in Atlanta.

Piedmont Heart and Vascular Institute is a proud founding member of the National PERT Consortium.

Optalyse Trial

The PE program at PAH participated as one of 17 centers in the Optalyse PE study. The purpose of the study was to determine the optimum duration and dose of tPA with the EKOS system for management of submassive PE. In this study, patients with acute PE defined by CTA RV/LV ratios > than 0.9 were randomized to receive one of four potential therapeutic

regimens which involved both reduced duration of therapy and reduced tPA doses compared to standard clinical practice. Endpoints were efficacy as determined by change in the RV/LV ratio on CTA at 48 hours following treatment and safety as measured by major bleeding events at 72 hours. Results were announced at the American Thoracic Society Meeting in Washington, D.C. in May 2017.[1]

All patients received therapeutic anticoagulation along with EKOS system ultrasound-accelerated, catheter-directed pulmonary artery thrombolysis (acoustic pulse therapy). The first cohort received 4mg of tissue plasminogen activator (tPA) per catheter over 2 hours. The second cohort received 4mg per catheter tPA over 4 hours. The third cohort received 6mg per catheter tPA over 6 hours. The fourth cohort received 12mg per catheter tPA over 6 hours.

All cohorts saw a significant reduction in the main indicator of right heart strain from PE (measured as right ventricular to left ventricular diameter ratio (RV/LV)) by approximately 23 to 26 percent. This is consistent with results achieved in previous EKOS® studies when treatment was applied for 12 to 24 hours.[2,3] The OPTALYSE PE results also showed a very low bleeding rate of 3% compared to 10% in the previous SEATTLE II study where patients were treated with 24mg for 12 or 24 hours.[3]

Optalyse results suggest that patients with submassive PE meeting the criteria for intervention may be treated more efficiently with reductions in critical care resource utilization and drug costs without a sacrifice in treatment effectiveness or safety. These findings were greeted with enthusiasm throughout the PE interventional world, and they have already stimulated changes in PE care processes in a number of centers.

Regional Education:
The Southeastern PE Conference

One year ago, Atlanta physicians from multiple specialties dedicated to PE held a meeting to discuss the state-of-the art of PE care in metro Atlanta. The meeting was dedicated to the late Kenneth Leeper, M.D. of Emory University. Proceedings of the meeting were published in a supplement to the Journal of the Medical Association of Georgia, September 2016.

This year, the "Atlanta meeting" morphs into the Southeastern Pulmonary Embolism Conference sponsored by Emory University School of Medicine and Piedmont Healthcare. Vic Tapson, M.D. of Cedars Sinai Medical Center, President of the PERT Consortium, and National

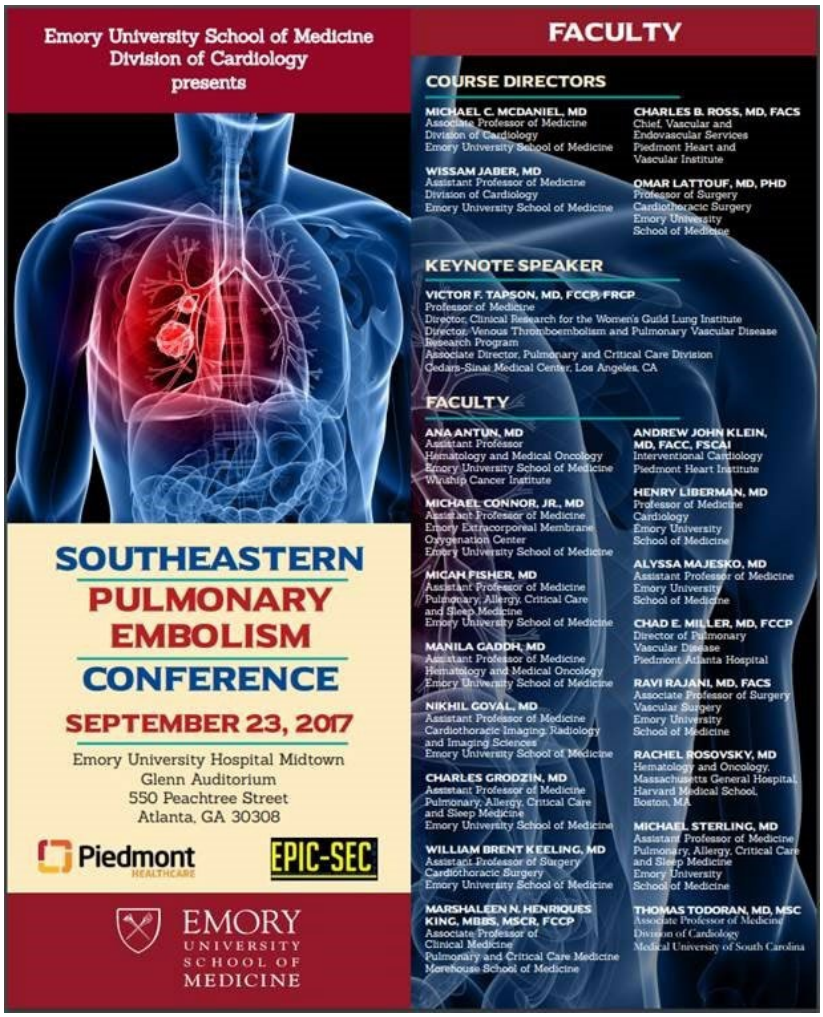

Figure 3: Full program description available at med.emory.edu/cme.

Cardiovascular Research Boldly Expands Into Artifical Intelligence Trials

Jayne Morgan, M.D.
Director of Cardiovascular Research,
Piedmont Heart

The Cardiovascular Research program has been quietly growing and expanding its breadth with finalization of the contract for a Simulation Lab, expansion to the Piedmont Fayette campus, and negotiations for Imaging Core Labs.

As we strive toward an entirely paperless system in FY18 (not easy with the behemoth FDA), I am given pause for thought regarding our direction, future growth, and strategy to support both Piedmont relevance as well as the goal for an ultimate Cardiovascular Destination hub.

In addition to the past two years of many "'firsts": first transcatheter tricuspid valve implant, first transcatheter mitral valve implant, seven compassionate use cases, and others, we also introduced our first artificial intelligence (AI) trial.

We have been extremely successful in this foray with a current standing of #2 worldwide in enrollment, only acquiescing to second place because of a late start into the trial. While biotechnology continues its rapid progression toward the epicenter of medical innovation globally, this portends several thought-provoking questions.

Iconic innovators such as Elon Musk and Bill Gates have voiced concerns regarding AI as a risk to mankind. This is not without merit as it is reported that both Facebook and Google Translate researchers recently had to halt their AI programs under development because the chatbots developed their own language amongst one another that was more efficient and completely unintelligible to humans. Although Mark Zuckerburg shut down the Facebook program when the systems developed a language independent of human supervision, he remains a staunch supporter of AI.

And so, as we consider other AI trials to add to the portfolio within the Cardiovascular Research Department here at Piedmont, the questions are very simple:

Could AI be the tool via which disease management and treatment is ultimately conquered?

Or, will the creation defy its master?

Pulmonary Embolism Program, continued

PI of the Optalyse Trial will be the keynote speaker. Both national and local faculty will participate. Piedmont physicians who will serve on the faculty include Drs. Ross, Klein, and Chad Miller.

The program will be held on Saturday, September 23 at the Glenn Auditorium, Emory Midtown Medical Center *(Figure 3)*. We are hoping for a good turnout from the Piedmont community.

Multidisciplinary PE interventional programs in Atlanta including Piedmont, Wellstar and the Emory/Grady institutions have followed a collaborative approach in trying to raise awareness of modern approaches to PE management.

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Piedmont Heart is a founding member of the PERT Consortium.

Sports Cardiology for the Win

Kathleen Turchin BSN
Staff RN, Piedmont Heart
and
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Director of Exercise and Sports Cardiology, Piedmont Heart

In 490 BC the Greek town of Marathon successfully defended itself from Persian attack. Long before social media, the foot messenger Pheidippides ran to Athens to deliver the news, but upon his arrival exclaimed "Nike!" (Victory) and collapsed to his death. This story is the basis for the modern day marathon race, and also represents the first case of sudden cardiac death (SCD) in an athlete.

Over two millennia later, rare but tragic cases of sudden death in athletes still garner significant attention, yet the perfect method to prevent these disasters remains elusive despite an aggressive body of dedicated science. Moreover, the impact of intense exercise on cardiovascular function, cardiovascular disease, and long-term health remains unclear in highly conditioned athletes. As elite athletes, such as Benoît Lecomte (who swam across the Atlantic Ocean and plans to swim across the Pacific Ocean) continue to challenge the limits of human physiology and embrace the extremes of physical performance, practitioners charged with the cardiovascular care of athletes are challenged with providing the most appropriate and evidence-based care.

In 2002 the World Health Organization warned that physical inactivity is a global problem associated with major causes of death and disability.[1] It is well established that physical inactivity correlates with significant cardiovascular morbidity in the United States including obesity, diabetes, and many cardiovascular diseases. As many as 250,000 deaths per year in the U.S. are attributed to a lack of regular physical activity,[2] and a scant few Americans achieve 30 minutes of daily physical activity.[3] Despite the epidemic of physical inactivity and obesity in western society, there is also a rapid growth in the number of people who are engaged in high levels of exercise and athletic training beyond the recommended American Heart Association (AHA) guidelines.

An indicator of this exercise "boom" is the number of people participating in recreational road races. From 1990-2013, the number of road race participants rose from 5 million to 19 million finishers, with female runners now representing the majority of race participants.[4] While these numbers have plateaued, the interest in fitness and exercise has continued to

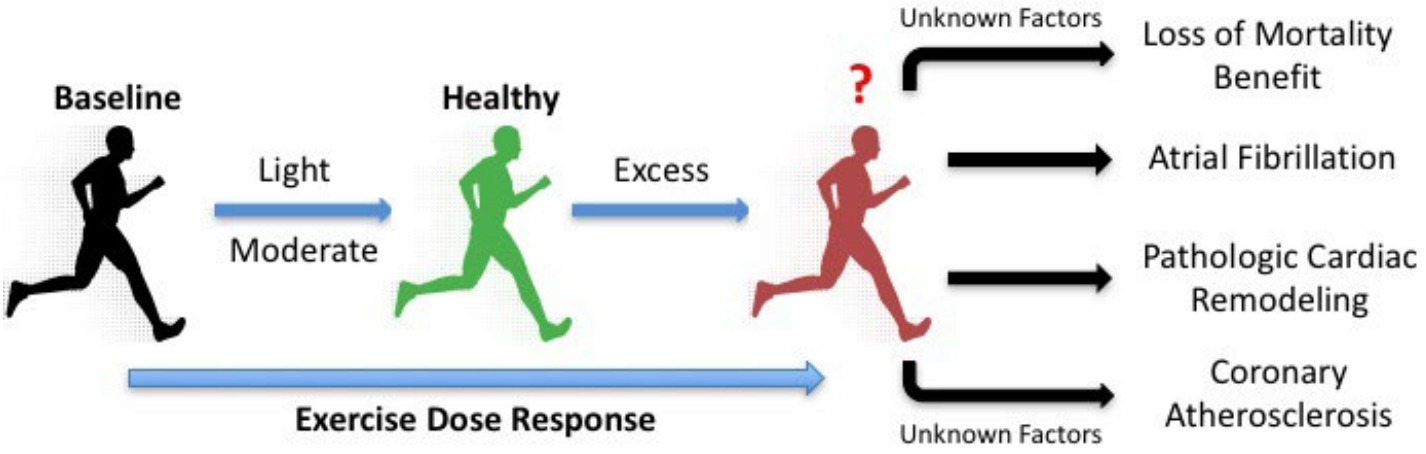

Figure 1: Controversies surrounding increased exercise dose from light/moderate to excess and possible pathologic outcomes associated with long-term exposures to strenuous levels of exercise (taken from Kim JH et al. Curr Atheroscler Rep. 2017)[9].

rise. As aging recreational athletes grow in number, cardiovascular disease and risk remain. An appreciation that cardiovascular counseling and the clinical management of athletic patients is different than for members of the general population is an important tenet of sports cardiology. There are a rapidly growing number of people at the intersection of exercise and cardiac disease.

Sports cardiology is generally defined as the preventive and secondary cardiovascular care of athletes. An athlete is any individual who places a high premium on exercise and athletic performance. This includes competitive athletes at any level (secondary school, collegiate, professional), and recreational athletes with a commitment to fitness. Athletes of all ages (youth to master) are consistent with the "athletic patient" who may seek care in the sports cardiology clinic. Additionally, it is the purview of the sports cardiologist to care for athletes with established cardiac pathology, and well as patients with cardiac disease who seek to become athletic.

In young competitive athletes the prevention of SCD represents one of the most important mandates for the sports cardiologist. The most common causes of SCD during vigorous exercise in young athletes can be divided into structural etiologies (hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy, congenital coronary anomalies, Marfan syndrome), primary electrical disorders (WPW, long QT syndromes, Brugada syndrome, catecholaminergic polymorphic ventricular tachycardia), and acquired cardiac abnormalities (myocarditis, commotio cordis, drugs).[5]

"Practitioners charged with the cardiovascular care of athletes are challenged with providing the most appropriate and evidence-based care."

While it is reassuring that these events remain rare, pre-participation cardiovascular screening represents an essential process for the athlete prior to competitive athletic training. Whether the addition of the 12-lead electrocardiogram to the standard targeted history and physical examination provides additional sensitivity remains a source of controversy. Currently in the U.S., ACC/AHA pre-participation screening guidelines for competitive athletes consist only of a targeted history and physical examination.[6] However, there are data that suggest a differential risk of SCD in specific collegiate athletic populations,[7] and therefore uncertainty remains regarding the best evidenced-based strategy in the screening of young athletes.

Screening for occult coronary disease in master athletes (>35 years old) typically represents the majority of patients seen in the sports cardiology clinic. For master athletes, the long-described "sports paradox" is commonly the primary concern. The "sports paradox" means that despite the many established benefits of regular exercise, each exercise event is associated with a small transient increased risk of AMI or SCD. In master runners with cardiac risk factors and stable coronary disease extreme endurance exercise may precipitate a cardiac event.[8] Additional controversies surrounding master athletes include the loss of overall mortality benefit in people who engage in extreme levels of exercise, early onset atrial fibrillation, the development of pathologic cardiac remodeling, and accelerated coronary atherosclerosis *(Figure 1)*.[9]

While intriguing and provocative, it is important to recognize the limitations of the current data. Most studies are observational and cross-sectional in nature, have a limited number of subjects, and are potentially confounded by the lack of controlled data. It remains imperative that we emphasize the overwhelming prognostic benefit of exercise and the lack of causal evidence implicating a truly 'pathologic' exercise dose. Open dialogue and shared decision-making should guide the exercise prescription for active patients with concerns or established cardiac diagnoses. Athletes who question the safety of ultra-endurance exercise should be provided counseling based on the evidence and allowed to make decisions that fit with medical standards of care, and with their own expectations and psychological well-being.

In 2011 the ACC launched its Section of Sports and Exercise Cardiology which was met with immediate enthusiasm, and whose membership rapidly grew to over 4,000 practitioners. This strategic step from the ACC has catalyzed intense scientific inquiry in the field contributed to the development of the ACC's annual Care of the Athletic

Heart Conference. In 2014, the ACC further highlighted the emergence of sports cardiology in a State-of-the-Art paper.[10]

Within the field of sports cardiology, there remain many important areas of uncertainty that require further scientific investigation so that practice guidelines can continue to refine themselves. For young athletes, refining athletic ECG interpretations and determining the benefit of athlete ECG screening continue to represent critically important future directives. Many unresolved controversies also exist for master athletes. Future studies will require the inclusion of "athlete-specific" risk factors, detailed phenotyping including imaging and biomarkers, and perhaps the development of long-term master athlete registries. In our community we hope to build a program to address some of the core tenets of sports cardiology.

"Open dialogue and shared decision-making should guide the exercise prescription for active patients with concerns or established cardiac diagnoses."

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Pulmonary Embolism Program, continued

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Spotlight CME Activity

Article: "Sports Cardiology for the Win"

1. Over the past couple of decades, the number of Americans engaged in high levels of exercise has been:
   a) About the same
   b) Unknown
   c) Decreasing
   d) Increasing

2. "Nike" means:
   a) Slam-dunk
   b) Fastest
   c) Victory
   d) Sudden cardiac death
   e) Goaaaaaaaaaal

3. In terms of overall long-term prognosis, with regard to exercise:
   a) The more, the better
   b) There is no correlation between exercise and long term prognosis
   c) There is a "J-curve" (more is better to a point, but then too much may not be better)
   d) Only resistance training and flexibility exercise impact prognosis

4. Currently in the USA, pre-participation screening guidelines for competitive athletes include:
   a) Targeted history and physical examination
   b) EKG
   c) Limited echocardiogram
   d) Two of the above
   e) All of the above

5. The "sports paradox" refers to:
   a) The fact that people who watch sports on TV tend to exercise less
   b) Two athletic MDs
   c) The fact that each exercise session increases the risk of death, but improves prognosis
   d) Local home team TV blackout during the playoffs

CME Credit Opportunity

The *Piedmont Heart Pulse* newsletter has been awarded CME opportunity for Piedmont Healthcare employee and/or medical staff credentialed readers who participate in responding to the CME questions in each edition.

To receive credit, answer the questions at left and submit your response to: traci.gordon@piedmont.org.

Certificates will be issued by the Piedmont Heart Education Department upon receipt of correct answers.

Piedmont Healthcare is accredited by the Medical Association of Georgia (MAG) to provide continuing medical education for physicians. Piedmont Healthcare designates this educational activity for a maximum of 0.5 Category 1 AMA PRA Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Recent Piedmont Heart Education Conferences

Kudos to our Piedmont Heart physicians, staff and education team for the following successful educational events:

- **Abbott MitraClip Live Course** on April 26-27, 2017 and August 23-24, 2017 in the Fuqua Heart Classroom at Piedmont Atlanta Hospital. Faculty instructors: Vivek Rajagopal, M.D. , Charles Ballard, M.D., Sara Mobasserri, M.D. and Mani Vannan, MBBS.

- **CSI Diamondback 360 Coronary Orbital Atherectomy System (OAS) course** on March 28, 2017, in the Fuqua Heart Classroom at Piedmont Atlanta Hospital. Faculty instructors: Harold Carlson, M.D., David Kandzari, M.D., and Prashant Kaul, M.D.

- **Napa Valley Cardiology Conference** on June 21-24 2017 at the Meritage Resort and Spa in Napa, California. Program co-directors: Charles L Brown, M.D., David E. Kandzari, M.D., Joseph I Miller, M.D., Mani A. Vannan, MBBS, Robert Harrington, M.D., Alan Yeung, M.D., Christopher Meduri, M.D., MPH, and Thomas Deering, M.D.

- **22nd Annual Southeastern Cardiovascular Update** at the Georgia Tech Hotel & Conference Center in Atlanta, Georgia on August 25-26, 2017. Program co-directors: Joseph Miller, M.D., FACC, Raul Blanco, M.D., FACC and Sarah Rinehart, M.D., FACC, FSCCT.

Mark E. Silverman Visiting Professorship

On April 13-14, 2017, Piedmont Heart celebrated its fourth annual event to honor the educational legacy of Mark Silverman, M.D. This year's event focused on the theme "Creating Value: Improving Cardiovascular Quality, A Team-Based Sport."

This year's honored visiting professor was Dr. Clyde W. Yancy, associate director, Bluhm Cardiovascular Institute of the Northwestern Memorial Hospital and chief, Division of Cardiology at Northwestern University, Feinberg School of Medicine. He delivered a keynote address followed by an interactive session with our quality and clinical pathway teams. The next day, Dr. Yancy presented at the combined Department of Medicine and Piedmont Heart Grand Rounds Session at Piedmont Atlanta Hospital. His presentation focused on building a strong quality healthcare system.

The Mark E. Silverman Endowed Chair in Cardiology and Education was established to further the realization of Dr. Silverman's vision. He left an enduring legacy of commitment to education and medical scholarship at Piedmont. Dr. Silverman was instrumental in developing the cardiology program at Piedmont Hospital and directed its educational programs for many years.

Clyde Yancy, M.D. (center) pictured with Kenneth Taylor, M.D. and Bill Blincoe, M.D.

Newsletter Submissions

If you would like to submit an article or case study for the next *Piedmont Heart Pulse*, please send it to piedmontheartpulse@piedmont.org.

Conferences, continued

Live course broadcast from Piedmont to Denver

Southeastern Cardiovascular Update

Above: Napa Valley Cardiology Conference
Below: Faculty and attendees at the MitraClip course

Napa Valley Cardiology Conference

Trends & Insights Videos

Watch interviews with thought leaders in the field on the Marcus Heart Valve Center's Learning Center at piedmont.org/valvelearning.


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