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Minimally Invasive Heart Surgery

Understanding the New Hypertension Guidelines

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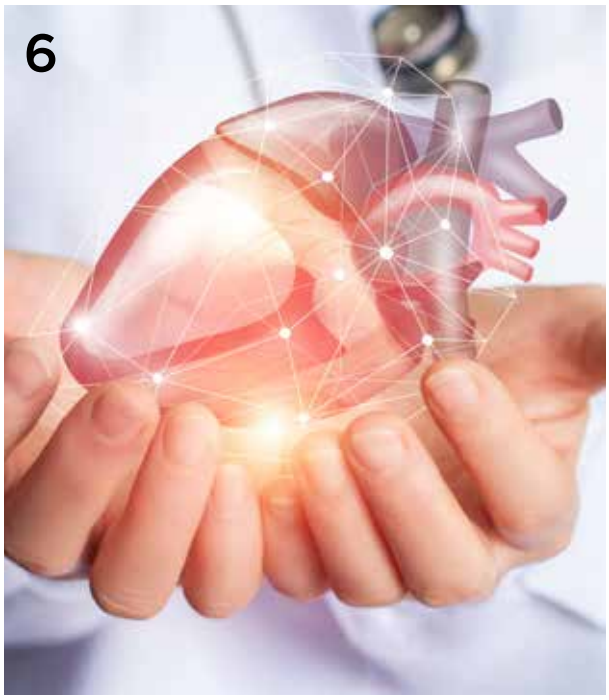
features



to our readers

Impressive advances continue to occur in the field of Cardiology as the emphasis grows for the development of less invasive treatment strategies for the evaluation and care of cardiovascular patients.

In this issue of Oklahoma Heart Institute Magazine, Dr. Joseph Gard, from the Electrophysiology Division, highlights the newer, leadless pacemakers that are now available for patients needing only ventricular pacing. These devices remove the need for more invasive approaches used to place standard pacemaker leads and alleviate the problems associated with pacemaker leads, such as infection.

Dr. Allen Cheng, from the Division of Cardiovascular and Thoracic surgery, describes the now available minimally invasive surgical procedures for valve repair and replacement. These procedures require more effort and skill on the part of the surgeon, but provide great results with much less morbidity for the patient.

Finally, disease prevention remains one of the great successes in Cardiology. The new hypertension guidelines are summarized in this issue. These guidelines will help decrease the incidence of heart attacks, strokes, and cardiovascular deaths if implemented.

We hope that you enjoy the articles and welcome any comments or suggestions regarding the magazine content.

Sincerely,

Wayne Leimbach

Wayne N. Leimbach, Jr., MD
Publisher/Editor, Oklahoma Heart Institute Magazine

"Tulsa Skyline — Beginning of a Colorful Sunrise" by Tyler Layne

Figure 1. A traditional transvenous pacemaker with a lead is shown on the left portion of the image as opposed to the leadless Micra pacemaker shown on the right portion of the image. Image courtesy of Metronic.

Leadless Pacemaker Therapy

By Joseph J. Gard, MD, FACC, FHRS

Pacemakers are cardiac devices that stimulate heart beats with small painless electrical impulses. Initially, electrical impulses were created by generator devices outside the body that were transmitted by wires called leads into the body to the heart. Pacing therapy was revolutionized in 1958 when a pacemaker system (the generator and the lead) was first fully implanted in a patient. This concept of a pacemaker generator being connected via a lead within a vein to the heart is called a transvenous system. The transvenous system was the standard pacing system for decades. The lead was identified as the vulnerable part of the pacing system and a source of potential risk to the patient. Thus, engineers and physicians sought to revolutionize pacing therapy with the development of a leadless pacemaker, and the FDA approved the Medtronic Micra Transcatheter Pacing System in 2016 (Figure 1).

The Micra implant procedure differs from the traditional transvenous pacemaker implant. The Micra is delivered to the heart via the femoral vein in the groin (Figure 2). The right femoral vein is commonly used in cardiology for a variety of diagnostic and therapeutic procedures. The Micra is held in place in the heart by small soft anchoring hooks. After the Micra

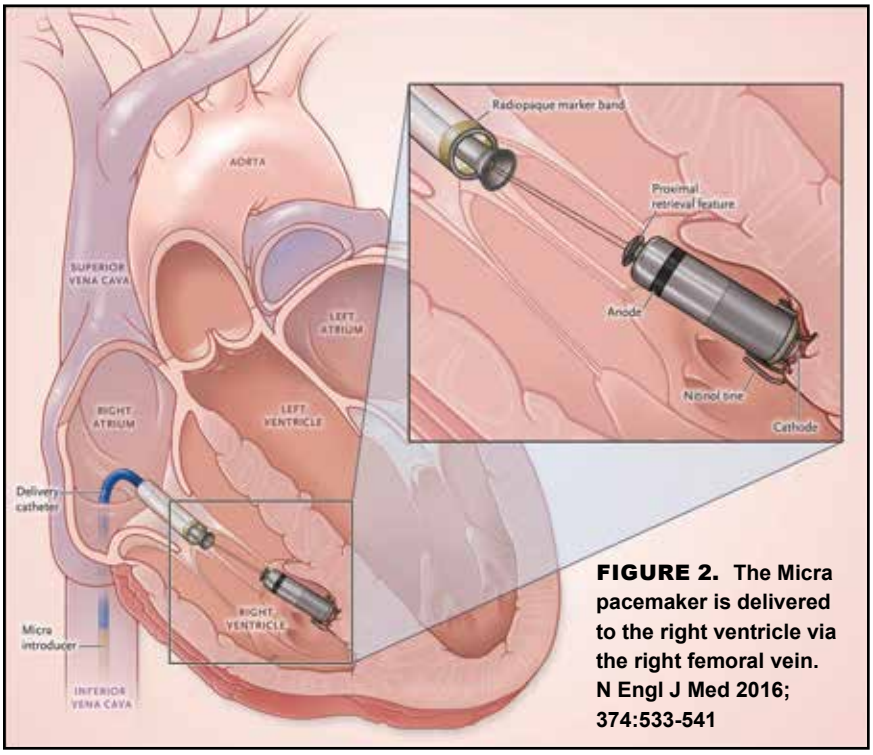


FIGURE 2. The Micra pacemaker is delivered to the right ventricle via the right femoral vein. N Engl J Med 2016; 374:533-541

is implanted, the delivery system is removed from the vein and all that is left in the body is the small leadless pacemaker within the heart. Micra is 1.75 grams and has a volume of 0.8 cc (Figure 3). The Micra implant procedure takes about an hour, which is similar to implanting a transvenous pacemaker. After the delivery tool is removed, the vein in the groin needs to heal. This typically involves four hours of bedrest and a ten pound lifting restriction for two weeks following the procedure. After a traditional transvenous pacemaker implant, there is generally an activity restriction to avoid lifting the arm on the pacemaker side above the elbow for one month so that the lead can heal, but since Micra does not have a lead there is no arm movement limitation after Micra implant.

The Micra offers similar features as the traditional transvenous pacemaker that has a single lead to the heart. Although its primary function is to pace to prevent slow heart beats, the Micra also has a sensor to increase the heart rate with activity (rate-responsive pacing), it can adjust its output energy to what is needed to stimulate the heart (capture-management), it is MRI-conditional, and has remote monitoring capability. A pacemaker's battery life depends on a variety of factors, such as has how much it paces and how much energy it uses for each pacing stimuli (pacing threshold). Micra has a similar battery longevity to the transvenous pacemaker.

The Micra leadless pacing system has some important differences from the traditional transvenous pacemaker. The primary difference is how many locations the devices can stimulate. The heart's upper chambers, called the atria, are like primary pumps for the heart. The heart's lower chambers, called the ventricles, are the primary pumps generating circulatory blood flow. Micra stimulates the right ventricle similarly to how a single lead (VVIR) pacemaker simulates the heart.

This electrically stimulates both the ventricles to squeeze. Some patients can benefit from stimulating multiple areas of the heart to coordinate the timing of the upper and lower chambers (AV timing) and from coordinating right and left venticular stimulation (resychonization timing). The transvenous pacemaker can have two or three leads to allow for these additional timing functions that single chamber transvenous or Micra does not offer. Patients with atrial fibrillation who are troubled by symptoms of slow heart beats despite having a normal squeeze function of the heart (ejection fraction) are excellent candidates for Micra.

There are many benefits of a leadless pacemaker compared to the traditional transvenous pacemaker. The leadless pacemaker has cosmetic benefit as it is entirely within the heart and thus avoids bulky pacemaker generator "bulge" by the collarbone and there is no scar left on the chest. A major concern with implanting any device is the risk of infection. There is a much lower risk of infection for a leadless pacemaker compared to a traditional transvenous pacemaker.

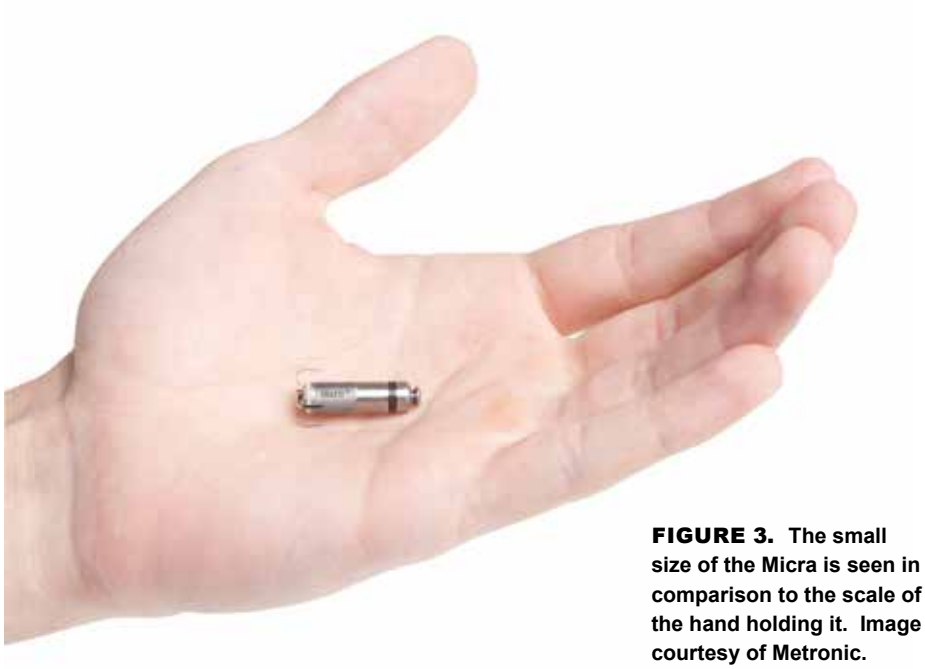


FIGURE 3. The small size of the Micra is seen in comparison to the scale of the hand holding it. Image courtesy of Metronic.

This advancement offers the greatest advantage to patients who have an indication for a single chamber (VVIR) pacemaker as it has all the functionality of the traditional transvenous pacemaker.

Implanting a pacemaker lead involves puncturing a hole in a chest vein near the lung and puts patient at risk for a lung injury (pneumothorax) and having one or more leads within the vein can lead to scarring and obstruction of the utilized veins. Within the heart the lead then travels thru the tricuspid valve which can damage its function. Transvenous leads and Micra have anchoring mechanisms to hold them in place within the heart, but which can cause bleeding complications (cardiac tamponade) and, despite the anchoring mechanisms, there is risk of dislodgement. Clinical trial data has shown patients implanted with Micra have fewer hospitalizations related to implant complication and fewer revisions of the pacing system compared to the historical outcomes for patients with the traditional transvenous pacemaker. In the clinical trial there was a very high rate of successful implant and low rate of major complications (96% had no major complication in the first six months after implant).

The introduction of leadless pacemakers was a major technological advancement after more than fifty years of using the traditional approach pacing leads. This advancement offers the greatest advantage to patients who have an indication for a single chamber (VVIR) pacemaker as it has all the functionality of the traditional transvenous pacemaker. The pacing community is hopeful that technology will continue to evolve to allow leadless coordinated pacing of multiple sites within the heart.

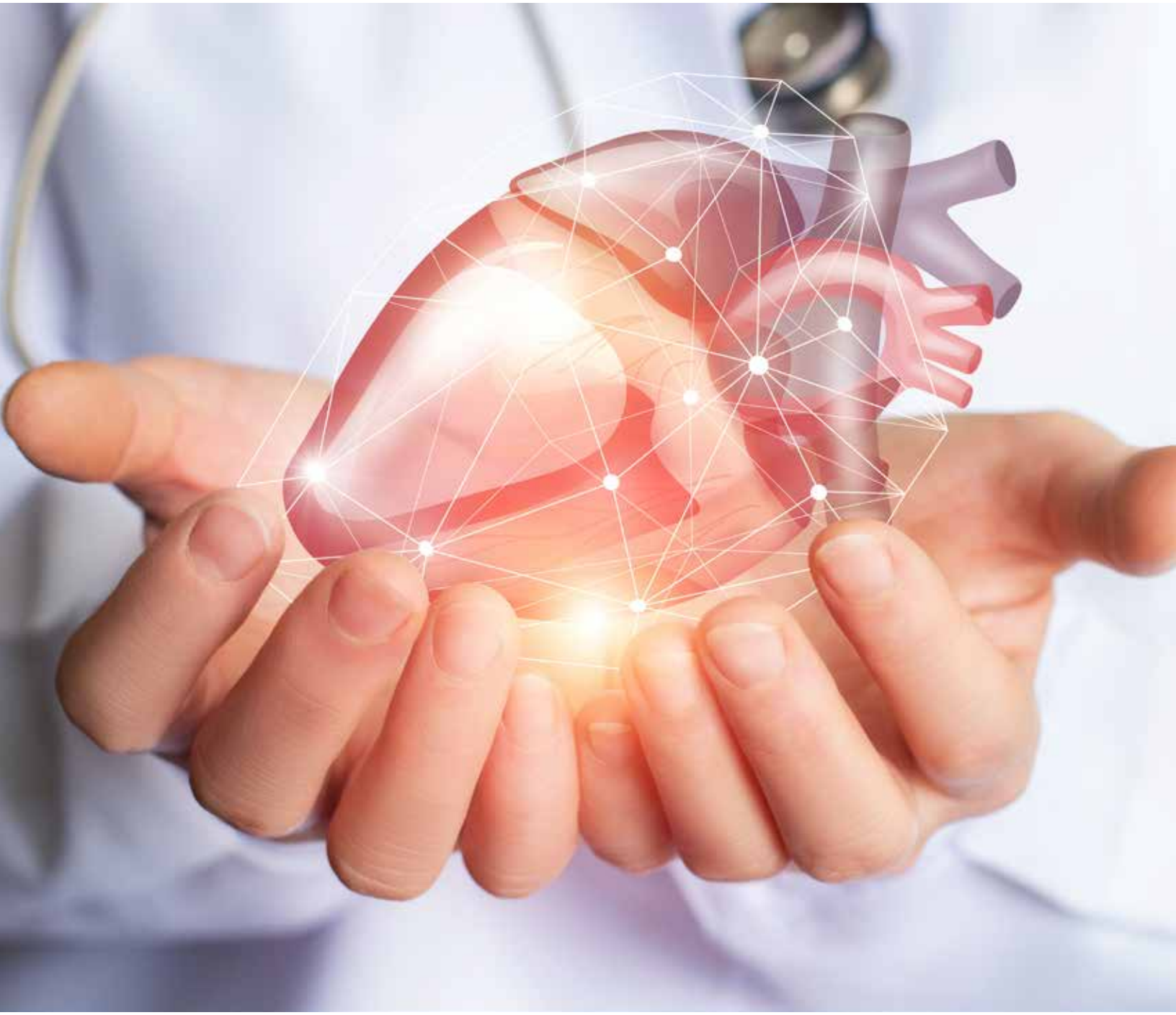
Dr. Gard is a cardiologist who specializes in electrophysiology, complex ablation and atrial fibrillation management. He completed his Cardiac Electrophysiology Fellowship and his Cardiology Fellowship at the Mayo School of Graduate Medicine in Rochester, Minnesota.

References

1. Reference [1]: Images Paediatr Cardiol. 2006 Apr-Jun; 8(2): 17–81.
2. Reference [2]: N Engl J Med 2016; 374:533-541

Minimally Invasive Heart Surgery:
All Patients Deserve to Have the Option

By Allen Cheng, MD and Amy Ramsey, RN



INTRODUCTION

In minimally invasive heart surgery (MIS), also known as keyhole surgery, the surgeon performs heart surgery through small incisions (Figure 1b) without a sternotomy (splitting the breastbone) (Figure 1a). Rather, the surgeon operates through small incisions with specialty-designed instruments and camera scopes (Figure 2), which will result in less pain and trauma and a quicker recovery for many patients. This approach will also allow the surgeon to have a better visualization of certain parts of the heart, resulting in a more comprehensive operation (Figure 3). Numerous publications have been published and data has shown patients who underwent MIS procedures have a faster recovery time, shorter hospital stay, lower infection rate, less surgical pain and less blood loss and more (1-4).

Minimally invasive heart surgery has been offered at major medical centers and has a long history. However, it has been lacking in the state of Oklahoma for a long time. We are glad we are offering this skill and technology initiated by Dr. Allen Cheng at Oklahoma Heart Institute, because with its benefits, all patients deserve to have the option.

INDICATIONS

Most patients requiring open-heart surgery can qualify for minimally invasive heart surgery. Especially patients who have valve (mitral, aortic and tricuspid valve) regurgitation and stenosis will benefit from minimally invasive heart surgery. Both valve repair and replacement can be performed minimally invasively. It is important to emphasize that for patients with primary mitral regurgitation (e.g leaflet prolapse), as will be discussed below, mitral valve repair (instead of replacement) should be performed by an experienced surgeon who specializes in both mitral valve repair and minimally invasive heart surgery. Other indications for minimally invasive heart surgery include coronary artery disease, congestive heart failure (left ventricular assist device placement), congenital heart disease (e.g. atrial septal defect), atrial fibrillation, and atrial myxoma (Table 1). Similar to traditional open-heart surgery screening, all minimally invasive heart surgery patients will undergo pre-operative screening, including CT scan, echocardiogram and cardiac catheterization to determine candidacy.

BENEFITS

Numerous reports have been published and attested the benefits of minimally invasive heart surgery. Some benefits of minimally invasive heart surgery are provided in Table 2. The benefits include smaller incision, less pain (no bone division), less wound infection, faster recovery, shorter hospital stay, less bleeding, and equally important, minimally invasive heart surgery allows surgeon to have a direct and better visualization of the anatomy for a more comprehensive repair or replacement (Figure 3). Below are a few publications with a good study sample size, reporting the outcomes of minimally invasive heart surgery. Galloway et al. from New York University reported their minimally invasive mitral repair long-term outcomes over a 10-years period (1). They examined 1601 patients who underwent minimally invasive mitral valve repair and compared them with patients who had conventional open-heart surgery (full sternotomy). They showed the long-term survival and freedom from reoperation after minimally invasive surgery are excellent and are comparable to conventional full sternotomy. They also reported hospital mortality was significantly lower with minimally invasive approach (p=0.04); deep wound infection rate was lower (0% vs. 2.4%, p=0.05); the need for blood products were less (p=0.02) and hospital stays were shorter (p=0.009). Iribarne et al. from Columbia University examined 847 patients who underwent minimally invasive mitral valve surgery (2). They reported minimally invasive patients required shorter intubation time (p=0.019); a higher proportion of MIS patients discharged home with no nursing services requirement (p=0.018), and a lower readmission rate and shorter hospital stay for MIS patients (p=0.023, p=0.001 respectively). In a meta-analysis, Moscarelli et al. reported that stroke rate (p=0.02), blood transfusion rate (p=0.006) and postoperative atrial fibrillation (p=0.0007) rate were all lower in MIS patients vs. conventional sternotomy patients (3). There are many other reports published regarding the benefit of minimally invasive heart surgery.

Figures 1a and 1b

Direct comparison of minimally invasive heart surgery incision (1b) vs. conventional open-heart sternotomy (breast bone splitting) (1a). The arrow (1b) indicates the minimally invasive incision.

Figure 1a

Conventional open heart surgery (sternotomy, breastbone splitting)

Figure 1b

Minimally invasive heart surgery (small incision, no bone cutting, less tissue trauma)

Numerous publications have been published and data has shown patients who underwent MIS procedures have a faster recovery time, shorter hospital stay, lower infection rate, less surgical pain and less blood loss and more.

(continued on p. 8)

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MINIMALLY INVASIVE MITRAL VALVE REPAIR

For patients with chronic primary mitral regurgitation, it should be emphasized the importance of mitral valve repair opposed to mitral valve replacement. The American Heart Association guidelines (5,6) have distinctly stated that mitral valve repair is preferred over mitral valve replacement in patients with severe chronic primary mitral regurgitation (e.g. posterior and anterior mitral leaflet prolapses) as a Class 1 indication. A number of reports have been published reviewing the benefits of mitral valve repair over replacement, including the Society of Thoracic Surgery database studies (6). Mitral valve repair is performed at a lower operative mortality. The operative risk (30-day mortality) for repair is about half that of mitral replacement (5). (Left heart/ventricular function is better preserved following repair, which preserves the integrity of the mitral valve apparatus (5,6).) Mitral repair also avoids the risks inherent to prosthetic heart valves in replacement, that is, thromboembolism or anticoagulant-induced bleeding for mechanical valves or structural deterioration for bioprosthetic valves (5). Various mitral repair techniques have been proposed and developed over the years (7-9) and have a steep learning curve for heart surgeons. It is surgically demanding and it is recommended (AHA guideline) that patients with mitral regurgitation should be referred to a surgeon who specialize in mitral valve repair (5,6). The advancement of minimally invasive mitral repair has improved patient outcomes as reported in many studies as discussed above. It has also allowed surgeons to have a better visualization of the mitral apparatus (leaflets, papillary muscles, chords, and annulus), due to the anatomy of the heart and its approaches, which is crucial for a comprehensive and successful repair (Figure 3). Patients will certainly benefit more from a heart surgeon who specializes in both minimally invasive heart surgery and mitral valve repair.

MINIMALLY INVASIVE TRICUSPID VALVE REPAIR

Many patients suffer from tricuspid regurgitation. It is estimated that approximately 1.6 million individuals in the USA have at least moderate or severe tricuspid regurgitation and they are frequently undertreated (10-12). Tricuspid regurgitation can be well tolerated; however, in the presence of pulmonary hypertension, cardiac output declines and right heart failure worsens. Significant tricuspid regurgitation can lead to functional impairment and has an adverse impact on long-term survival (5). Patients with primary tricuspid regurgitation suffer from ascites, liver failure, lower extremities swelling, shortness of breath, generalized fatigue and will eventually develop right heart failure. Reduction or elimination of the regurgitant volume with tricuspid repair can alleviate systemic venous and hepatic congestion and decrease reliance on diuretics. Patients with severe congestive hepatopathy may also benefit from surgery to prevent irreversible cirrhosis of the liver (5). Quality of life and duration of long-term survival are related to residual RV function. Correction of symptomatic severe TR is preferentially performed before onset of significant right heart dysfunction. American Heart Association (5) recommends patients with primary severe tricuspid regurgitation who have symptoms may have tricuspid valve repair. Furthermore, even for asymptomatic patients with severe primary tricuspid regurgitation, especially those with right heart dysfunction, tricuspid repair may be considered, according to the guidelines (5). It has also been suggested that a tricuspid annulus diameter greater than 40mm or 21 mm/m² or severe tricuspid regurgitation with

(continued on p. 10)

Table 1

Indications of Minimally Invasive Heart Surgery

- Mitral valve regurgitation and stenosis (mitral valve repair or replacement)
- Tricuspid valve regurgitation and stenosis (tricuspid valve repair and replacement)
- Aortic valve regurgitation and stenosis (aortic valve repair and replacement)
- Double valvular disease (e.g., combined mitral and tricuspid repair or replacement)
- Atrial septal defect and patent ductus ovale (surgical closure)
- Atrial fibrillation (biatrial maze IV with radiofrequency and cryoprecipitate ablations, total thoracoscopic hybrid maze, convergent ablation, left atrial appendage ligation)
- Atrial mxyoma (resection)
- Coronary artery disease (MICAB, bypass)
- Congestive heart failure (MIS LVAD placement)

Table 2

Benefits of Minimally Invasive Heart Surgery

- No breast bone splitting (no sternotomy associated morbidity)
- Less pain with reduced trauma
- Smaller incision
- Better cosmesis
- Shorter recovery time – return to normal activities quicker
- Shorter length of hospital stay
- Lower wound infection rate due to smaller incision
- Lower risk of pneumonia (ambulate earlier, cough better with less pain)
- Less blood loss/decreased blood transfusion requirement
- Better and direct visualization of valves for better repair and replacement (better visualization than conventional open-heart surgery)

Figure 2

Intraoperative pictures illustrating the surgical approach of minimally invasive heart surgery and the use of specialty-designed instruments and retractors.

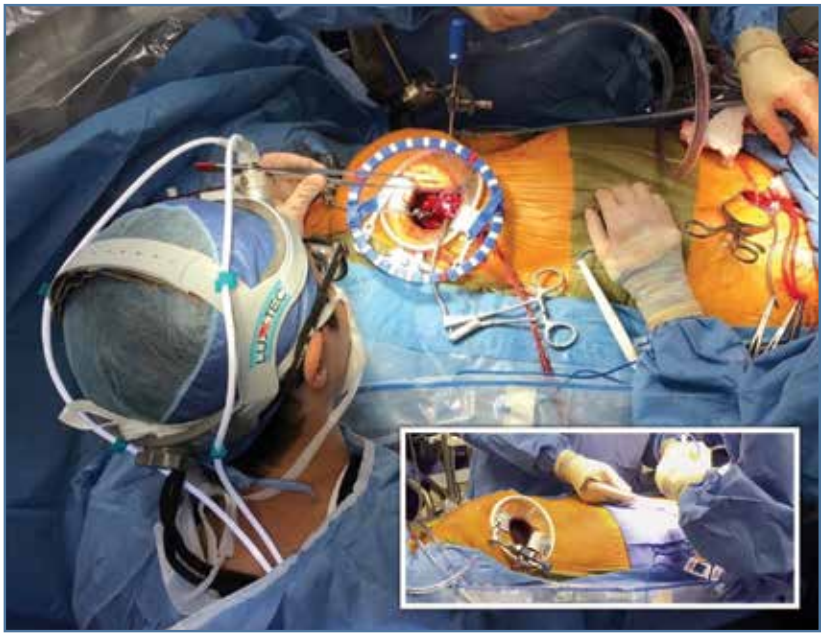

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Figure 3

Intraoperative pictures showing the great direct visualization of the mitral valve components (mitral annulus, leaflets, papillary muscle and chordae) with minimally invasive approach which is crucial for a comprehensive mitral repair.

the existence of pulmonary hypertension should indicate the need for tricuspid repair (5). Tricuspid regurgitation patients who required left-sided heart valve repair, a double valve repair can also be performed minimally invasively with good results (13). With the advancement in minimally invasive heart surgery, along with its proven benefits (Figures 1-4), minimally invasive tricuspid repair can be performed safely to improve quality of life and outcomes.

SURGICAL TECHNIQUE

Minimally invasive heart surgery is performed through a small incision (4-5cm) on the side of the chest (mini-thoracotomy) (Figure 1b). Depending on the valve(s) involved or other pathology, the location of incision can vary. For example, patients with mitral valve disease, the incision will be on the right lateral aspect of the chest (Figures 1 and 2). Minimally invasive heart surgery does not require bone division or rib cutting (Figure 1). Groin (femoral) vessels are used for cardiopulmonary bypass and general anesthesia will be induced. Specialty-designed instruments are used in minimally invasive heart surgery including soft tissue retractor, long instruments, thoracoscope, specialized left atrial and mitral retractor (Figure 2). The surgeon performs the repair or replacement under direct vision. Due to the anatomy of the heart, minimally invasive surgery approach has allowed surgeons to have a better visualization of the pathology (Figure 3)

Figure 4

A photograph depicting a minimally invasive heart surgery incision when a patient was seen in the clinic two weeks postoperatively.

and to perform a more comprehensive repair. In general, patients only need to stay in the ICU one night and will be able to ambulate and transfer to a regular room the next day depending on the patients' comorbidities and preoperative conditions.

CONCLUSION

Minimally invasive heart surgery should be offered to qualified patients who require open heart surgery. Many reports have been published demonstrating its benefits. With its steep learning curve and skill set required, an experienced minimally invasive surgeon should be selected. Mitral repair should be emphasized for all patients with severe primary chronic mitral regurgitation. For patients with symptomatic severe tricuspid regurgitation, early intervention is recommended before right heart function worsens and congestive hepatopathy becomes irreversible liver cirrhosis. With the advancement in minimally invasive heart surgery and its proven benefits, all patients deserve to have the option.

Dr. Cheng is a cardiovascular surgeon who specializes in heart transplantation, mechanical circulatory support, ECMO, minimally invasive cardiac surgery, atrial fibrillation surgery (MAZE), and transcatheter aortic valve replacement. He is also a scientific investigator at Cardiovascular Innovation Institute. Dr. Cheng has received multiple national awards including the Howard Hughes Medical Institute research award, American Heart Association (AHA) research award, Thoracic Surgery Foundation for Research and Education (TSFRE) research award and the Society of Heart Valve C. Walton Lillehei research award. He has an extensive publication record in major international cardiovascular journals including Circulation, Annals of Thoracic Surgery, Journal of Heart and Lung Transplantation and ASAIO, and is also serving as a reviewer for the above journals.

REFERENCES

1. Galloway AC, Schwartz CF, Ribakove GH, Crooke GA, Gogoladze G, Ursomanno P, Mirabella M, Culliford AT, Grossi EA. A decade of minimally invasive mitral repair: long-term outcomes. Ann Thorac Surg. 2009 Oct;88(4):1180-4.
2. Iribarne A, Easterwood R, Russo MJ, Chan EY, Smith CR, Argenziano M. Comparative effectiveness of minimally invasive versus traditional sternotomy mitral valve surgery in elderly patients. J Thorac Cardiovasc Surg. 2012 Apr;143(4 Suppl):S86-90.
3. Moscarelli M, Fattouch K, Casula R, Speziale G, Lancellotti P, Athanasiou T. What is the role of minimally invasive mitral valve surgery in high-risk patients? A meta-analysis of observational studies. Ann Thorac Surg. 2016;101:981-9.
4. Ricci D, Boffini M, Barbero C, El Qarra S, Marchetto G, Rinaldi M. Minimally invasive tricuspid valve surgery in patients at high risk. J Thorac Cardiovasc Surg. 2014 Mar;147(3):996-1001.
5. Nishimura RA, Otto CM, Bonow RO, Carabello BA, Erwin JP, Guyton RA, O'Gara PT, Ruiz CE, Skubas NJ et. Al. 2014 AHA/ACC guideline for the management of patients with valvular heart disease: a report of the American college of cardiology/American heart association task force on practice guidelines. J Thorac Cardiovasc Surg. 2014. Jul;148(1):e1-e132.
6. Nishimura RA, Otto Cm, Bonow RO, Carabello BA, Erwin JP, Fleisher LA, Jneid H, Mack MJ, et. Al. 2017 AHA/ACC focus update of the 2014 AHA/ACC guideline for the management of patients with valvular heart disease: A report of the American College of Cardiology/American Heart Association Task Force on clinical practice guidelines. Circulation. 2017 Jun 20;135(25):e1159-e1195.
7. Cheng A, Nguyen TC, Malinowski M, Liang D, Daughters GT, Ingels NB, Miller DC. Undersized mitral annuloplasty inhibits left ventricular basal wall thickening but does not affect equatorial wall cardiac strains. J Heart Valve Dis. 2007 Jul;16(4):349-58.
8. Nguyen TC, Cheng A, Tibayan FA, Liang D, Daughters GT, Ingels NB, Miller DC. Septal-lateral annular cinching pertubs basal left ventricular transmural strains. Eur J Cardiothorac Surg. 2007 Mar;31(3):423-9.
9. Langer F, Rodriquez F, Cheng A, Ortiz S, Nguyen TC, Zasio MK, Liang D, Daughters GT, Ingels NB, Miller DC. Posterior mitral leaflet extension: an adjunctive repair option for ischemic mitral regurgitation? J Thorac Cardiovasc Surg. 2006 Apr;131(4):868-77.
10. Rodes-Cabau J, Taramasso M, O'Gara-PT. Diagnosis and treatment of tricuspid valve disease: current and future perspectives." Lancet. 2016. 388: 2431-2442.
11. Taramasso M, Vanermen H, Maisano F, Guidotti A, La Canna G, Alfieri). The growing clinic importance of secondary tricuspid regurgitation. J Am Coll Cardiol. 2012. 59 (8):703-10.
12. Irwin RB, Luckie M, Khattar RS. Tricuspid regurgitation: contemporary management of a neglect valvular lesion. Postgrad Med J 2010;86:648-55
13. Santana O, Xydas S, Williams RF, LaPietra A, Mawad M, Hasty F, Escolar E, Mihos CG. Outcomes of minimally invasive double valve surgery. J Thorac Disease. 2017 Jun;9(Suppl 7):S602-S606.

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Metabolic Disorders
- Diabetes
- Thyroid
- Hypertension
- Other Endocrine Problems

Specialty Clinics
- Advanced Center for Atrial Fibrillation
- Dysrhythmia and Pacer Clinic
- Hypertension Clinic
- Resistant Hypertension Clinic
- Adolescent and Adult Congenital Heart Clinic
- Lipid and Wellness Clinic
- Heart Failure Clinic
- Same Day Appointment Clinic
- Pre-Operative Clinic
- Center for the Treatment of Venous Disease
- Sleep Care
- Center for Peripheral Arterial Disease
- The Valve Clinic

Cardiovascular Surgery

CARDIAC SURGERY
- Coronary Artery Bypass
- Surgical Aortic Valve Replacement
- Transcatheter Aortic Valve Replacement with TAVR Team
- Mitral and Tricuspid Valve Repair and Replacement
- Surgical Treatment of Atrial Fibrillation: “Mini-Maze”, Full Maze, Left Atrial Appendage Ligation
- Cardiac Tumor Resection

THORACIC NON-CARDIAC SURGERY
- VATS (Video Assisted Thoracoscopy Surgery) for Biopsy and Treatment
- Minimally Invasive and Open Techniques for Diagnosis and Staging of Lung and Nonpulmonary Cancer in the Chest
- Minimally Invasive and Open Techniques for Therapeutic Lung Cancer Resection
- Surgical Treatment of Esophageal Cancer and Benign Esophageal Conditions

VASCULAR SURGERY
- Endovascular and Open Treatment of Aortic Aneurysms: Abdominal and Thoracic Diagnosis, Surgical, Interventional and Medical Management of Peripheral Arterial Disease (PAD)
- Surgical Treatment of Carotid Occlusive Disease
- Limb Salvage

MEDIASTINAL SURGERY
- Evaluation and Treatment of Mediastinal Masses

THYROID/ENDOCRINE SURGERY
- Full Spectrum of Thyroid Surgery (Total versus Near Total Thyroidectomy)
- Parathyroid Surgery with Intraoperative PTH monitoring
- Recurrent Nerve Monitoring

Oklahoma Heart Institute Hospital	Oklahoma Heart Institute at Utica Physicians Offices	Oklahoma Heart Institute at Southpointe Physicians Offices	Oklahoma Heart Institute At Hillcrest Hospital South
1120 S. Utica Avenue Tulsa, OK 74104 P) 918.574.9000	1265 S. Utica Avenue Tulsa, OK 74104 P) 918.592.0999 • F) 918.595.0208	9228 S. Mingo Road Tulsa, OK 74133 P) 918.592.0999 • F) 918.878.2408	8801 S. 101st E. Avenue Tulsa, OK 74133 P) 918.592.0999

THE DOCTORS OF OKLAHOMA HEART INSTITUTE

Wayne N. Leimbach, Jr., MD, FACC, FACP, FSCAI, FCCP, FAHA

Dr. Leimbach is a specialist in interventional and structural cardiology, including cardiac catheterization, coronary angioplasty, stents, atherectomy, laser, intravascular ultrasound imaging, and direct PTCA/stents for acute myocardial infarction. He also specializes in percutaneous closure of PFOs, ASDs, PDAs and percutaneous valve replacement or repair procedures such as TAVR and MitraClip. He is Director of the Cardiac and Interventional Laboratories at Oklahoma Heart Institute Hospital and also is Past Chief of Cardiology. Dr. Leimbach is Co-Founder of the Lipid and Wellness Clinic at Oklahoma Heart Institute. He is Director of the James D. Harvey Center for Cardiovascular Research at Hillcrest Medical Center, as well as Director of the Oklahoma Heart Research and Education Foundation. He also serves as Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine-Tulsa. Dr. Leimbach completed a Clinical Cardiology Fellowship and a Research Fellowship at the University of Iowa Hospitals and Clinics. He also completed his Internal Medicine Internship and Residency Programs at Iowa, where he was selected Chief Resident in Medicine. He received his medical degree from Northwestern University in Chicago and his Bachelor of Science degree from the University of Michigan.
Board certified in Internal Medicine, Cardiovascular Disease and Interventional Cardiology

Robert C. Sonnenschein, MD, FACC, ASE, RVT, RPVI

Dr. Sonnenschein specializes in echocardiography and noninvasive peripheral vascular imaging. He is Director of Echocardiography at Hillcrest Hospital South and past Director of Peripheral Vascular Ultrasound Imaging at Hillcrest Medical Center and Oklahoma Heart Institute and serves as Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine – Tulsa. He completed his Cardiology Fellowship at the State University of New York Upstate Medical Center in Syracuse, where he also completed his Internal Medicine Internship and Residency programs. Dr. Sonnenschein received his medical degree from Rush Medical College in Chicago and his Bachelor of Arts degree from the University of Pennsylvania.
Board certified in Internal Medicine, Cardiovascular Disease, and Adult Echocardiography Registered Vascular Technologist

James J. Nemec, MD, FACC

Dr. Nemec is a specialist in echocardiography, stress echocardiography and nuclear cardiology. He serves as Director of Nuclear Cardiology for Oklahoma Heart Institute. Dr. Nemec has served as Assistant Professor of Internal Medicine, Division of Cardiology, at Creighton University and as Assistant Professor, Department of Radiology, also at Creighton University. He completed his Clinical Cardiology Fellowship at the Cleveland Clinic Foundation and his Internal Medicine Internship and Residency at Creighton University. Dr. Nemec also completed a year of training in pathology at the University of Missouri, Columbia, MO. He received his medical degree from Creighton University, where he also received his Bachelor of Arts degree.
Board certified in Internal Medicine, Cardiovascular Disease and Nuclear Cardiology

Gregory D. Johnsen, MD, FACC, FSCAI

Dr. Johnsen is an interventional cardiologist with expertise in cardiac catheterization, angioplasty and related interventional procedures, such as stents and atherectomy. He is Director of Cardiac Rehabilitation at Hillcrest Medical Center and Director of the Hillcrest Exercise and Lifestyle Programs. He completed his Clinical Cardiology Fellowship at the University of Oklahoma – Oklahoma City, where he then finished an extra year of dedicated training in interventional cardiology. He completed his Internal Medicine Internship and Residency training at the University of Oklahoma – Oklahoma City, where he also received his medical degree. Dr. Johnsen received his Bachelor of Science degree from Oklahoma State University.
Board certified in Internal Medicine, Cardiovascular Disease and Interventional Cardiology

Alan M. Kaneshige, MD, FACC, FASE, RPVI

Dr. Kaneshige is a noninvasive cardiologist with expertise in adult echocardiography, stress echocardiography and transesophageal echocardiography. He is Director of Congestive Heart Failure at Oklahoma Heart Institute and Past Chief of Cardiology at Hillcrest Medical Center. Dr. Kaneshige completed his Internal Medicine Internship and Residency at Creighton University School of Medicine, where he also received his medical degree. He received a Bachelor of Science in chemistry at Creighton University. Dr. Kaneshige completed his Clinical Cardiology fellowship at Creighton, where he also served as Chief Cardiology Fellow for two years. He completed an additional Cardiac Ultrasound Fellowship at the Mayo Clinic in Rochester. Dr. Kaneshige served as Assistant Professor of Medicine at Creighton University School of Medicine, where he was Director of the noninvasive Cardiovascular Imaging and Hemodynamic Laboratory.
Board certified in Internal Medicine, Cardiovascular Disease, Adult and Transesophogeal Echocardiography

Edward T. Martin, MS, MD, FACC, FACP, FAHA , FSCMR

Dr. Martin is a noninvasive cardiologist with subspecialty expertise in noninvasive imaging. He is Director of Cardiovascular Magnetic Resonance Imaging at Oklahoma Heart Institute and Hillcrest Medical Center. In addition, he is a Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine – Tulsa. Dr. Martin has specialty training in Nuclear Medicine, as well as additional training dedicated to Cardiovascular Magnetic Resonance Imaging. He completed his Cardiology Fellowship at the University of Alabama and Internal Medicine Internship/Residency training at Temple University Hospital in Philadelphia. He received his medical degree from the Medical College of Ohio. Dr. Martin completed his Master of Science degree in mechanical engineering at the University of Cincinnati and his Bachelor of Science degree in physics at Xavier University. Dr. Martin is a founding member of the Society of Cardiovascular Magnetic Resonance and is a past editorial board member of the Journal of Cardiovascular Magnetic Resonance. Dr. Martin has also been actively involved with the American College of Cardiology (ACC) on a national level participating on numerous committees, writing groups and leadership positions. He is also a past ACC Governor of the State of Oklahoma. He is also a two-time past President of the Board of Directors of Tulsa Metropolitan Division of the American Heart Association and past President of the Intersocietal Commission for the Accreditation of Magnetic Resonance Laboratories (ICAMRL). Locally, he is the current Director of Cardiovascular MRI at OHI and the current Chief of Staff at Hillcrest Hospital South.
Board certified in Internal Medicine and Cardiovascular Disease

Roger D. Des Prez, MD, FACC

Dr. Des Prez is a noninvasive cardiologist with specialty expertise in echocardiography, nuclear cardiology and cardiac computed tomography. He is Director of Cardiac Computed Tomography Services of the Cardiology Department at Bailey Medical Center. Dr. Des Prez received his medical degree and Bachelor of Arts degree from Vanderbilt University. He completed his Residency in Internal Medicine and Pediatrics at University Hospital of Cleveland. Dr. Des Prez practiced for six years as an internist with the Indian Health Services in Gallup, NM. He returned to Vanderbilt University as a member of the Internal Medicine Faculty, at which time he also completed his cardiology training.
Board certified in Internal Medicine, Cardiovascular Disease, Echocardiography, Pediatrics and Nuclear Cardiology

Christian S. Hanson, DO, FACE

Dr. Hanson is a specialist in Endocrinology, Metabolism and Hypertension at Oklahoma Heart Institute with expertise in diabetes, lipids and hypertension. He also serves as Clinical Associate Professor of Medicine in the College of Osteopathic Medicine – Oklahoma State University. He completed a Fellowship in Endocrinology, Metabolism and Hypertension at the University of Oklahoma in Oklahoma City. Dr. Hanson's Internal Medicine Residency and Rotating Internship were completed at Tulsa Regional Medical Center. He received his medical degree from Oklahoma State University and his Bachelor of Science degree from Northeastern Oklahoma State University in Tahlequah.
Board certified in Internal Medicine, Endocrinology and Metabolic Diseases

David A. Sandler, MD, FACC, FHRS

Dr. Sandler is a cardiologist with subspecialty expertise in electrophysiology, complex ablation, and atrial fibrillation management. Dr. Sandler is Director of Electrophysiology at Oklahoma Heart Institute Hospital. He completed his Cardiac Electrophysiology Fellowship and his Cardiovascular Medicine Fellowship at New York University Medical Center, New York, NY. Dr. Sandler performed his Internal Medicine Internship and Residency at Mount Sinai Medical Center, New York, NY. He earned his medical degree from Georgetown University School of Medicine in Washington, DC. Dr. Sandler received his Bachelor of Arts degree at the University of Pennsylvania in Philadelphia.
Board certified in Internal Medicine, Cardiovascular Disease and Cardiac Electrophysiology

Raj H. Chandwaney, MD, FACC, FSCAI, FSVM

Dr. Chandwaney is an interventional cardiologist with expertise in cardiac catheterization, coronary angioplasty and related interventional procedures such as coronary stents, atherectomy, intravascular ultrasound and peripheral

vascular interventional procedures. Dr. Chandwaney is Chief of Cardiology and Director of the Chest Pain Center and Cardiology Telemetry Unit at Oklahoma Heart Institute Hospital. He completed his Clinical Cardiology Fellowship at Northwestern University Medical School in Chicago, IL., where he also completed an Interventional Cardiology Fellowship. Dr. Chandwaney's Internal Medicine Internship and Residency were performed at Baylor College of Medicine in Houston, TX. He received his medical degree from the University of Illinois at Chicago. Dr. Chandwaney completed his Master of Science degree at the University of Illinois at Urbana-Champaign, where he also received his Bachelor of Science degree.
Board certified in Internal Medicine, Cardiovascular Disease, Interventional Cardiology and Endovascular Medicine

D. Erik Aspenson, MD, FACE, FACP
Dr. Aspenson is a subspecialist in Endocrinology, Metabolism and Hypertension at Oklahoma Heart Institute, with expertise in diabetes, lipids, hypertension and thyroid diseases. He completed a fellowship in Endocrinology at Wilford Hall Medical Center, Lackland AFB, Texas. Dr. Aspenson's Internal Medicine Internship and Residency were completed at David Grant Medical Center, Travis AFB, California where he served as Chief Resident. He received his medical degree from the University of Oklahoma and his Bachelor of Science degree at Oklahoma State University.
Board certified in Internal Medicine, Endocrinology and Metabolic Diseases

Frank J. Gaffney, MD, FACC
Dr. Gaffney is an interventional and noninvasive cardiologist with subspecialty expertise in transesophageal echocardiography, nuclear cardiology, and coronary angiography. Dr. Gaffney is Director of Cardiology at Bailey Medical Center. He completed his Cardiovascular Medicine Fellowship at Scott & White Memorial Hospital in Temple, Texas. Dr. Gaffney completed his Internal Medicine Internship and Residency at Brooke Army Medical Center in San Antonio. He then remained on staff at Scott & White Memorial Hospital for several years, before entering his Fellowship in Cardiovascular Medicine. Dr. Gaffney earned his medical degree from New York Medical College, Valhalla, New York, and he received his Bachelor of Arts degree at Hofstra University in Hempstead, New York.
Board certified in Internal Medicine, Cardiovascular Disease and Nuclear Cardiology

Eric G. Auerbach, MD, FACC
Dr. Auerbach is a general cardiologist whose major interest is preventive cardiology and cardiovascular risk reduction. He completed his Cardiology Fellowship at the University of Miami/Jackson Memorial Hospital in Miami, FL, following which he obtained additional subspecialty training in cardiovascular MRI, nuclear cardiology, and cardiac CT imaging. His areas of expertise also include echocardiography, stress testing and management of lipid disorders. In addition to holding board certification in cardiovascular disease, he is a diplomat of the American Board of Clinical Lipidology. Dr. Auerbach's Internal Medicine Internship and Residency were performed at the University of Miami/Jackson Memorial Hospital. He earned his medical degree at the University of Miami, Miami, FL, and his Bachelor of Arts degree at Princeton University, Princeton, NJ. Dr. Auerbach is the Director of Preventive Cardiology at Oklahoma Heart Institute, the medical director of The Weight Loss & Wellness Center at Oklahoma Heart Institute and a Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine – Tulsa.
Board certified in Internal Medicine, Cardiovascular Disease and Nuclear Cardiology

Robert L. Smith, Jr., MSc, MD, FACC, FSCAI
Dr. Smith specializes in interventional cardiology including cardiac catheterization, coronary angioplasty, and related interventional procedures such as coronary stents, atherectomy, intravascular ultrasound, and peripheral vascular interventional procedures. Dr. Smith is Director of Cardiology and the Cardiac and Interventional Laboratories at Hillcrest Hospital South. He completed an Interventional Cardiology Fellowship at the University of Florida College of Medicine in Jacksonville, FL. Dr. Smith performed his Clinical Cardiology Fellowship at Vanderbilt University School of Medicine in Nashville, TN and Tulane University School of Medicine in New Orleans. He received his medical degree from the University of Oklahoma College of Medicine in Oklahoma City and then completed his Internal Medicine Internship and Residency at Emory University School of Medicine in Atlanta, GA. Dr. Smith received his Bachelor of Arts, Bachelor of Science and Master of Science degrees at the University of Oklahoma in Norman, OK.
Board certified in Internal Medicine, Cardiovascular Disease, Interventional Cardiology and Nuclear Cardiology

Craig S. Cameron, MD, FACC, FHRS
Dr. Cameron is a specialist in cardiac electrophysiology, including catheter ablation of arrhythmias, atrial fibrillation management, pacemakers, implantable defibrillators, and cardiac resynchronization devices. Dr. Cameron is Director of Electrophysiology at Hillcrest Hospital South. He completed his Cardiac Electrophysiology Fellowship and his Cardiovascular Disease Fellowship at Baylor University Medical Center in Dallas, TX. Dr. Cameron's Internship and Internal Medicine Residency were performed at Baylor College of Medicine in Houston. He earned his medical degree from the University of Kansas School of Medicine in Kansas City, KS. Dr. Cameron received his Bachelor of Science degree at Pittsburg State University in Pittsburg, KS.
Board certified in Cardiovascular Disease and Cardiac Electrophysiology

Eugene J. Ichinose, MD, FACC
Dr. Ichinose specializes in interventional cardiology including cardiac catheterization, coronary angioplasty and related interventional procedures such as coronary stents, atherectomy, intravascular ultrasound and peripheral vascular interventional procedures. Dr. Ichinose is Director of Vein Services at Hillcrest Medical Center. He completed his Interventional and Clinical Cardiology Fellowships and his Internal Medicine Residency at the University of Massachusetts Memorial Health Care Center in Worcester, MA. Dr. Ichinose received his medical degree from Louisiana State University in New Orleans. He earned his Bachelor of Science degree from Texas Christian University in Fort Worth, TX.
Board certified in Internal Medicine, Cardiovascular Disease, Interventional Cardiology and Nuclear Cardiology

Cristin M. Bruns, MD
Dr. Bruns is a specialist in Endocrinology, Diabetes and Metabolism at Oklahoma Heart Institute, with expertise in diabetes, thyroid disease (including thyroid cancer) and polycystic ovary syndrome. She completed her Internal Medicine Internship and Residency and Endocrinology Fellowship at the University of Wisconsin Hospital and Clinics in Madison, WI. Dr. Bruns earned her medical degree from Saint Louis University School of Medicine in St. Louis, MO and her Bachelor of Arts and Bachelor of Science degrees in biology from Truman State University in Kirksville, MO. Prior to joining Oklahoma Heart Institute, Dr. Bruns worked as a clinical endocrinologist at the Dean Clinic in Madison, Wisconsin.
Board certified in Internal Medicine, Endocrinology and Metabolic Diseases

John S. Tulloch, MD
Dr. Tulloch is a noninvasive cardiologist with expertise in adult echocardiography, peripheral vascular imaging, nuclear cardiology, cardiac computed tomography and MRI. Dr. Tulloch is Director of the Cardiac and Vascular Ultrasound Department of Oklahoma Heart Institute/Hillcrest Medical Center's Cardiovascular Diagnostics. He completed his Cardiovascular Fellowship at the University of Kansas Medical Center in Kansas City, KS. Dr. Tulloch's Internal Medicine Internship and Residency also were completed at the University of Kansas Medical Center. He earned his medical degree from Ross University School of Medicine in New Brunswick, NJ and received his Bachelor of Science degree in biology from Avila University in Kansas City, MO.
Board certified in Internal Medicine, Cardiovascular Disease, Cardiovascular Tomography, and Nuclear Cardiology

Anthony W. Haney, MD, FACC
Dr. Haney is a noninvasive cardiologist with expertise in nuclear cardiology, echocardiography, peripheral vascular imaging and MRI. He also performs diagnostic cardiac catheterization. He completed his Cardiovascular Fellowship at the Medical College of Virginia in Richmond. Dr. Haney's Internal Medicine Internship and Residency were completed at the Mayo Clinic in Scottsdale, AZ. He earned his medical degree from the University of Oklahoma School of Medicine.
Board certified in Internal Medicine, Cardiovascular Disease and Nuclear Cardiology

Douglas A. Davies, MD, FACC, FASNC
Dr. Davies is a hospital-based cardiologist who provides continuity of care for patients admitted to Oklahoma Heart Institute – Hospital. He completed a Clinical Cardiology Fellowship and additional training in nuclear cardiology at the Medical College of Virginia, where he also completed his Internal Medicine and Residency programs. Dr. Davies received his medical degree from Johns Hopkins University School of Medicine in Baltimore.
Board Certified in Internal Medicine, Cardiovascular Disease, Nuclear Cardiology and Cardiovascular Computed Tomography Angiography

Kamran I. Muhammad, MD, FACC, FSCAI
Dr. Muhammad is a subspecialist in interventional cardiology. In addition to expertise in traditional areas of interventional cardiology, such as coronary intervention (angioplasty, stent placement, atherectomy, intravascular imaging) and peripheral vascular and carotid artery intervention, Dr. Muhammad has a special interest and expertise in interventional therapies for structural and valvular heart disease including the percutaneous non-surgical replacement and repair of heart valves — TAVR and MitraClip. As such, he currently serves as the Director of the Structural Heart Disease Program at OHI.

With dedicated and advanced training in structural heart disease intervention from the world-renowned Cleveland Clinic, Dr. Muhammad has been a pioneer in this field in Oklahoma. He led a team of OHI physicians in performing the first transcatheter aortic valve replacements (TAVR) and first transcatheter mitral valve repairs (MitraClip) in Tulsa and the region. Under his direction, these programs are the most experienced and comprehensive programs of their kind in the state, providing our patients with expert care and class-leading technologies for the non-surgical treatment of structural and valvular heart diseases.

In addition to his clinical experience, Dr. Muhammad has authored many peer-reviewed articles and textbook chapters on important cardiology topics. He also serves as Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine — Tulsa.

Dr. Muhammad completed his Clinical Cardiology and Interventional Cardiology Fellowships at the Cleveland Clinic which included additional dedicated training in peripheral vascular and structural cardiac intervention. Dr. Muhammad completed his Internal Medicine Internship and Residency at Yale University where he was selected and served as Chief Resident. He earned his medical degree from the University of Massachusetts Medical School, graduating with top honors and election to the Alpha Omega Alpha (ΑΩΑ) honor society. Dr. Muhammad earned his Bachelor of Science degree in computer science from the University of Massachusetts, Amherst.

Board certified in Internal Medicine, Cardiovascular Disease, Nuclear Cardiology and Interventional Cardiology

Arash Karnama, DO, FACC

Dr. Karnama is a specialist in interventional cardiology, including cardiac catheterization, coronary intervention, nuclear cardiology, echocardiography (TEE/TTE), cardioversion, peripheral angiography, peripheral intervention, carotid angiography, intravascular ultrasound, atherectomy, and PTCA/stenting for acute myocardial infarction. He is Director of the Cardiology Department at Hillcrest Hospital Claremore. Dr. Karnama completed his Interventional and Clinical Cardiology Fellowships at Oklahoma State University Medical Center and his Internal Medicine Internship and Residency at the Penn State Milton S. Hershey Medical Center in Hershey, PA. Dr. Karnama received his medical degree from Des Moines University in Des Moines, IA and his Bachelor of Arts degree from the University of Iowa in Iowa City.

Board certified in Internal Medicine, Interventional Cardiology, Cardiovascular Disease, Nuclear Cardiology, and Cardiovascular Computed Tomography

Victor Y. Cheng, MD, FACC, FSCCT

Dr. Cheng joins Oklahoma Heart Institute after serving as cardiology faculty at Cedars-Sinai Medical Center and assistant professor at the University of California in Los Angeles. Dr. Cheng is Director of the Cardiac Computed Tomography Department at Oklahoma Heart Institute and Hillcrest Medical Center. He is a specialist in noninvasive heart and vascular imaging, particularly in cardiac computed tomography (CT), a topic on which he has published numerous original research publications addressing quality, clinical use, and novel applications. Dr. Cheng's training includes a Clinical Cardiology Fellowship and Advanced Cardiac Imaging Fellowship at Cedars-Sinai Medical Center, and an Internal Medicine Internship and Residency at the University of California in San Francisco. Dr. Cheng received his medical degree from Northwestern University in Chicago, IL and his Bachelor of Science degree from Northwestern University in Evanston, IL.

Board certified in Internal Medicine, Cardiovascular Disease, Nuclear Cardiology, Echocardiography and Cardiovascular Computed Tomography

Jana R. Loveless, MD

Dr. Loveless is a sleep specialist, with expertise in the diagnosis and treatment of sleep disorders. She is Director of the Sleep Medicine Program at Hillcrest Hospital Claremore, Hillcrest Hospital Henryetta, and Hillcrest Hospital South. Prior to joining Oklahoma Heart Institute, Dr. Loveless was with Nocturna of Tulsa. She completed her Internal Medicine Residency program at the University of Oklahoma, Tulsa, where she was Chief Resident. She also earned her medical degree from, the University of Oklahoma, Tulsa. Dr. Loveless completed graduate studies at Texas Tech University, and she earned her Bachelor of Arts degree at Davidson College in Davidson, North Carolina.

Board Certified in Internal Medicine and Sleep Medicine

Mathew B. Good, DO, FACC, RPVI

Dr. Good is an invasive/noninvasive cardiology specialist with expertise in adult echocardiography, nuclear cardiology, cardiac computed tomography, peripheral vascular ultrasound and MRI. He completed his Cardiovascular Fellowship at the University of Kansas Medical Center in Kansas City, KS, where he also completed his Internal Medicine Internship and Residency. Dr. Good received his medical degree from the Oklahoma State University Center for Health and Sciences in Tulsa and his Bachelor of Arts degree from the University of Colorado in Boulder.

Board certified in Internal Medicine and Cardiovascular Computed Tomography

Stanley K. Zimmerman, MD, FACC, FSCAI

Dr. Zimmerman is the Director of the Catheterization Laboratory and Peripheral Vascular Services at Hillcrest Hospital South. He is the medical director of OHI vascular imaging laboratory. He is a specialist in interventional cardiology, including cardiac catheterization, coronary angioplasty, and related interventional procedures such as coronary stents, atherectomy, vascular ultrasound, and peripheral interventional procedures. Dr. Zimmerman specializes in complex vascular interventions, endovascular repair of abdominal aortic aneurysms and complex aorto-iliac disease, treatment of critical limb ischemia, and vascular management of arterial and venous based wounds.

He completed his Interventional and Cardiovascular Fellowships at the University of Kansas Medical Center in Kansas City, KS, as well as his Internal Medicine Internship and Residency. In addition, Dr. Zimmerman received his medical degree from the University of Kansas Medical Center and his Bachelor of Arts degree from the University of Kansas in Lawrence.

Board certified in Internal Medicine, Cardiovascular Disease and Interventional Cardiology

Michael Phillips, MD, FACC, FACS

Dr. Phillips is a Cardiovascular Thoracic Surgeon at Oklahoma Heart Institute. He completed his fellowship at Mid America Heart Institute in Kansas City, MO and his general surgery residency at the Mayo Graduate School of Medicine. He earned his medical degree from the University of Missouri. Dr. Phillips received his undergraduate degrees in Biology and Chemistry at William Jewell College in Liberty, MO.

Board certified by in Thoracic and General Surgery

James B. Chapman, MD, FACC, FSCAI

Dr. Chapman is a specialist in interventional cardiology, including cardiac catheterization, coronary angioplasty and related interventional procedures such as stents, atherectomy, laser, intravascular ultrasound imaging and direct PTCA for acute myocardial infarction. He completed a Clinical Cardiology Fellowship at St. Vincent Hospital and Health Care Center in Indianapolis, IN. He also completed his Internal Medicine Internship and Residency programs at St. Vincent. Dr. Chapman received his medical degree from Indiana University School of Medicine in Indianapolis and his Bachelor of Science degree from Indiana University in Bloomington, IN.

Board certified in Internal Medicine, Cardiovascular Disease and Interventional Cardiology

Joseph J. Gard, MD, FACC, FHRS

Dr. Gard is a cardiologist who specializes in electrophysiology, complex ablation and atrial fibrillation management. He completed his Cardiac Electrophysiology Fellowship and his Cardiology Fellowship at the Mayo School of Graduate Medical Education in Rochester, Minnesota. Dr. Gard also performed his Internal Medicine Residency at Mayo. He earned his medical degree from the University of Nebraska in Omaha, Nebraska. Dr. Gard received his Bachelor of Science degree from Boston College in Chestnut Hill, Massachusetts.

Board certified in Cardiovascular Disease, Internal Medicine, Electrophysiology and Clinical Cardiac Electrophysiology

Michael B. Newnam, MD

Dr. Newnam is Director of Sleep Medicine at Hillcrest Medical Center and Hillcrest Hospital Cushing. He is a Board Certified specialist in the diagnosis and treatment of sleep disorders. He completed his Family Practice Internship & Residency programs at the Womack Army Medical Center in Ft. Bragg, NC. Dr. Newnam earned his medical degree from the University of Oklahoma and his Bachelor of Science degree from Oral Roberts University in Tulsa, OK.

Board Certified in Family Medicine and Sleep Medicine

John M. Weber, MD, RPVI

Dr. Weber is a Peripheral Vascular Surgeon at Oklahoma Heart Institute who specializes in complex vascular disease. He offers both open and endovascular treatment of arterial and venous disease. Areas of interest include open and endovascular treatment of aortic pathology, cerebrovascular surgery, limb salvage surgery, vascular access, and complex venous therapies. He completed his residency in Vascular Surgery at the Cleveland Clinic in Cleveland, Ohio. Dr. Weber earned his medical degree at the University of Oklahoma College of Medicine. He also completed his undergraduate degree at the University of Oklahoma.

Saran Oliver, MD

Dr. Oliver is an invasive/noninvasive cardiology specialist with specific interests in adult echocardiography, nuclear cardiology, and women's cardiovascular health. She completed her Cardiovascular Fellowship at Scott and White Memorial Hospital in Temple, TX. Dr. Oliver performed her Internal Medicine Internship and Residency at the University of Texas Southwestern Medical Center in Dallas, TX. She also earned her medical degree from the University of Texas Southwestern Medical Center. Dr. Oliver attended Rice University in Houston, TX where she received her Bachelor of Arts degree in Sports Medicine.

Board certified in Internal Medicine, board eligible in Cardiovascular Medicine

Lauren LaBryer, MD

Dr. LaBryer is a specialist in Endocrinology, Metabolism and Hypertension at Oklahoma Heart Institute. She completed her Endocrinology Fellowship at the University of Oklahoma College of Medicine. She also completed her Internal Medicine Internship and Residency Programs at Oklahoma, where she was selected as Chief Resident in Medicine. In addition, Dr. LaBryer earned her medical degree from the University of Oklahoma College of Medicine. She received her Bachelor of Science degree in Biopsychology and Cognitive Sciences from the University of Michigan.

Board certified in Internal Medicine, Endocrinology and Metabolic Diseases

Jordan A. Brewster, MD

Dr. Brewster is a specialist in electrophysiology, with expertise in electrophysiology, complex ablation, and atrial fibrillation management. He completed his Fellowship in Electrophysiology at Indiana University in Indianapolis, IN. Dr. Brewster performed his Fellowship in Cardiovascular Disease at the University of Kentucky Division of Cardiovascular Medicine in Lexington, KY, where he was Chief Fellow. He completed his Internal Medicine Internship and Residency at Vanderbilt University in Nashville, TN. Dr. Brewster received his medical degree from the University of Virginia School of Medicine in Charlottesville, VA. and his Bachelor of Science degree in Biochemistry from the University of Oklahoma.

Board certified in Internal Medicine, Cardiovascular Disease and Nuclear Cardiology

Ahmad Iqbal, MD

Dr. Iqbal is an invasive/noninvasive cardiologist at Oklahoma Heart Institute who specializes in advanced heart failure patients, including those with left ventricular assist devices (LVAD) as well as patients with cardiac transplantation. His special interest is mechanical circulatory support options for patients requiring additional life support measures including ECMO, Impella, and LVADs. Dr. Iqbal also is a diplomate of the National Board of Echocardiography and specializes in adult comprehensive echocardiography, including stress echocardiography and transesophageal echocardiography. He also has an interest in nuclear and preventative cardiology. He completed his Advanced Heart Failure and Transplant Fellowship at Northwestern University Feinberg School of Medicine in Chicago, IL. Dr. Iqbal completed his Cardiovascular Disease Fellowship at Mid America Heart Institute at St. Luke's Hospital/University of Missouri-Kansas City, MO. Dr. Iqbal completed his Internal Medicine Residency at the University of Texas Southwestern in Dallas, TX. He received his medical degree from Tulane University School of Medicine and his Bachelor of Business Administration degree from Loyola University in New Orleans, LA, where he graduated summa cum laude.

Board certified in Internal Medicine, Cardiovascular Diseases, and Echocardiography. Board eligible in Nuclear Cardiology. Board eligible in Advanced Heart Failure and Transplant

Mrudula R. Munagala, MD, FACC

Dr. Munagala is Director of the Advanced Heart Failure program at Oklahoma Heart Institute. She specializes in Heart Failure, Mechanical Circulatory Support Devices (MCSD) and Transplant. Dr. Munagala is also experienced in managing patients with Pulmonary Hypertension and Cardiac Heart and Lung amyloidosis. She undertook advanced training in Heart Failure, MCSD and Transplant fellowship at UCLA-Ronald Reagan Medical Center in Los Angeles, CA after completing her Internal Medicine residency and Cardiovascular Diseases fellowship at Drexel University College of Medicine, Philadelphia, PA. She also completed a Heart Failure and Pulmonary Hypertension fellowship at Allegheny General Hospital, Pittsburgh, PA. Dr. Munagala received her medical degree from Sri Venkateswara Medical College in Andhra Pradesh, India. She has been involved in clinical research in Heart Failure, Ventricular Assist Devices (VAD) and Transplant and authored several articles and book chapters. She is an active member in various professional societies, including the American College of Cardiology, Heart Failure Society of America, International Society of Heart and Lung Transplant and American Medical Association.

Board Certified in Internal Medicine, Cardiovascular Diseases, Heart Failure and Transplant, Echocardiography and Nuclear Cardiology

Siva Soma, MD, FACC, FHRS

Dr. Soma is a specialist in electrophysiology, with expertise in complex catheter ablation of cardiac arrhythmias and management of atrial fibrillation, ventricular tachycardia, pacemakers, defibrillators and cardiac resynchronization devices.

He completed his Fellowship in Electrophysiology at the University of Pittsburgh Medical Center in Pittsburgh, PA. Dr. Soma performed his Fellowships in Cardiovascular Disease and Advanced Heart Failure/Transplantation at Allegheny General Hospital in Pittsburgh. He completed his Internal Medicine Internship and Residency at Hahnemann University Hospital, Drexel University College of Medicine in Philadelphia, PA.

Dr. Soma completed a Master's degree in public health and received his medical degree from Armed Forces Medical College in India.

Board certified in Internal Medicine, Cardiovascular Disease and Nuclear Cardiology

Ajit K. Tharakan, MD, M.Ch, FACS

Dr. Tharakan is a Cardiovascular Thoracic surgeon at Oklahoma Heart Institute. He was Chief Resident of Cardiothoracic Surgery at Massachusetts General Hospital, Harvard Medical School, Boston, MA, as well as Chief Resident of Cardiovascular Surgery at Boston Children's Hospital, Harvard Medical School, Boston, MA.

He was also Chief Resident for General Surgery at the Hugh E. Stephenson Department of Surgery, School of Medicine, University of Missouri, Columbia, MO, where he did his General Surgery Residency. He also was Chief Resident in Cardiothoracic Surgery at Christian Medical College & Hospital, Vellore, Tamilnadu, S. India. Dr. Tharakan has done additional training at St. John's National Academy of Health Sciences, Bangalore, India and Christian Medical College Hospital, Vellore, India where he secured the M.Ch (Master of Chirurgi) degree.

Dr. Tharakan performed his Internship at Sri Ramachandra Medical College & Research Institute, The Tamilnadu Dr. M.G.R. Medical University, Porur Madras, Tamilnadu, India, where he also earned his medical degree. Prior to joining Oklahoma Heart Institute, Dr. Tharakan was the Director of Cardiothoracic Surgery at the Hugh E. Stephenson Department of Surgery at the University of Missouri-Columbia. He has numerous publications, patents, and inventions. He was recognized as one of MU's Top Faculty Achievers in 2017.

Board certified in Thoracic and General Surgery

Allen Cheng, MD

Dr. Cheng is a cardiovascular surgeon who served as the Surgical Director of Heart Transplantation at Rudd Heart and Lung Center, Jewish Hospital, University of Louisville prior to joining Oklahoma Heart Institute.

He completed his general surgery residency at UCLA, cardiothoracic surgery training at Massachusetts General Hospital/Harvard Medical School, cardiovascular surgery postdoctoral fellowship at Stanford University and specialty training at University of Rochester.

Dr. Cheng specializes in heart transplantation, mechanical circulatory support, ECMO, minimally invasive cardiac surgery, atrial fibrillation surgery (MAZE), and transcatheter aortic valve replacement. He is also a scientific investigator at Cardiovascular Innovation Institute. Dr. Cheng has received multiple national awards including the Howard Hughes Medical Institute research award, American Heart Association (AHA) research award, Thoracic Surgery Foundation for Research and Education (TSFRE) research award and the Society of Heart Valve C. Walton Lillehei research award.

He has an extensive publication record in major international cardiovascular journals including Circulation, Annals of Thoracic Surgery, Journal of Heart and Lung Transplantation and ASAIO, and is also serving as a reviewer for the above journals.

Board certified in Surgery and Thoracic Surgery

Shahid Qamar, MD, FACC

Dr. Qamar is a cardiologist who specializes in advanced heart failure and mechanical circulatory support. Prior to joining Oklahoma Heart Institute, he served as Medical Director of the Heart Failure Clinic at Ascension Columbia St. Mary's Hospital in Milwaukee, WI.

He performed an Advanced Heart Failure Fellowship and a Transplant Fellowship at the University of Chicago in Chicago, IL. His General Cardiology Fellowship and Internal Medicine Residency were completed at Aurora Health Care in Milwaukee, WI

Dr. Qamar completed his General Surgery Residency at the Dow University of Health Sciences in Karachi, Pakistan, where he also earned his medical degree.

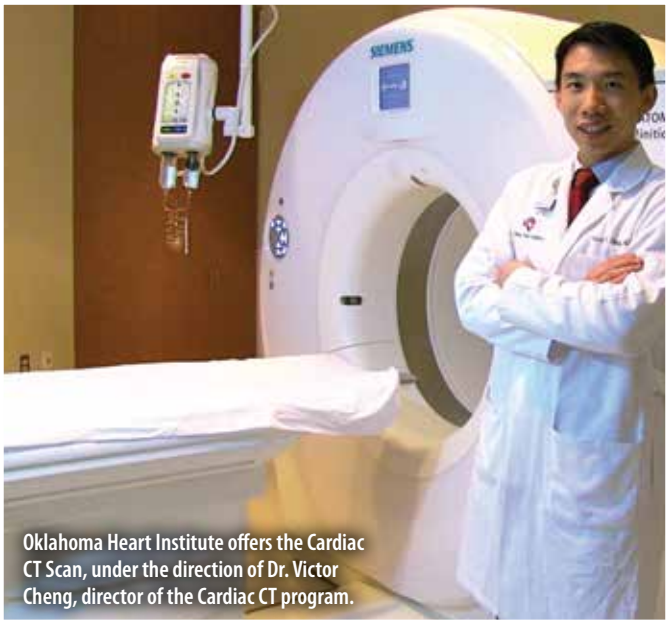
Board Certified in Internal Medicine and Cardiology

Adele M. Barkat, MD

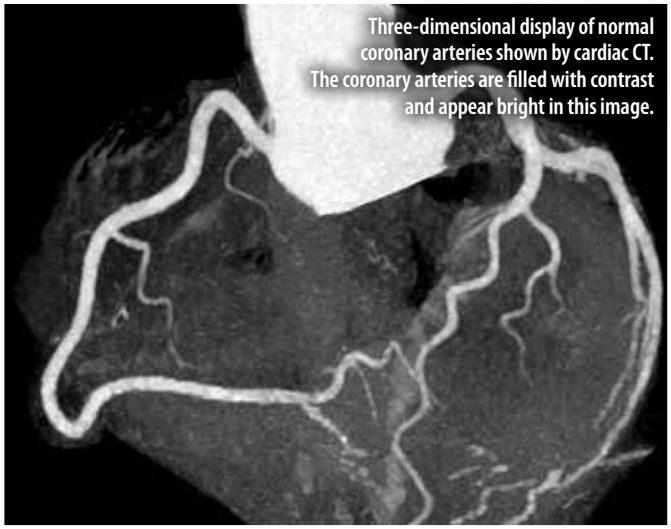
Dr. Barkat is a Vascular Surgeon at Oklahoma Heart Institute, who specializes in vascular and endovascular cases, including cerebrovascular, aortoiliac and infrainguinal occlusive disease, abdominal aneurysms, visceral arterial disease, arteriovenous access and venous interventions.

He performed a Vascular Surgery Fellowship at Loyola University Medical Center in Chicago, IL. Dr. Barkat completed his General Surgery Residency at Louisiana State University Health and Sciences Center in New Orleans, LA. He earned his medical degree at Louisiana State University Medical Center.

Dr. Barkat completed his Bachelor of Science degree at Louisiana State University with a degree in Biochemistry.



Oklahoma Heart Institute offers the Cardiac CT Scan, under the direction of Dr. Victor Cheng, director of the Cardiac CT program.



Three-dimensional display of normal coronary arteries shown by cardiac CT. The coronary arteries are filled with contrast and appear bright in this image.

Cardiac CT at Oklahoma Heart Institute

State-of-the-art scanner detects your risk for heart disease

Heart disease is the leading cause of death in the United States for men and women. But for many, the first symptom of heart disease is a heart attack.

In Tulsa, Oklahoma Heart Institute is changing that by offering a Cardiac CT Scan performed by a state-of-the-art ultrafast scanner that is more than 95 percent sensitive in detecting heart disease. The scanner creates detailed and accurate images of the heart and arteries in just seconds, all meaning easy and early detection of heart disease.

Dr. Victor Cheng administers this new technology at Oklahoma Heart Institute. Cheng, who came to OHI via Los Angeles' Cedars-Sinai Hospital, says using the Cardiac CT Scan is a good way to test if a patient's symptoms are due to heart disease or if a patient with significant risk factors has developed heart disease.

"For both symptomatic and asymptomatic individuals, Cardiac CT detects the presence and amount of plaque in the coronary arteries," Cheng says. "This information helps doctors tailor the intensity of recommended therapies to reduce heart attack risk and can motivate individuals to live a more heart-healthy lifestyle."

He adds, "For individuals with chest pain or breathlessness, Cardiac CT is the most reliable noninvasive test to show that the person does not have significant coronary artery blockage. The use of Cardiac CT in this situation determines whether additional evaluation or treatment for coronary artery disease is needed."

Cardiac CT is a painless screening test that uses an X-ray machine to take clear, detailed pictures of a heart and blood vessels. The scanner uses 50-90 percent less radiation than earlier generation scanners. The average patient is exposed to a radiation dosage comparable to a mammogram. This one-time radiation exposure is considered quite safe.

For individuals concerned about, or are at risk for, heart disease, Cardiac CT detects if there is no disease, mild disease or severe disease. Cardiac CT also effectively determines presence of heart disease in those who have undergone a stress test with an inconclusive result.

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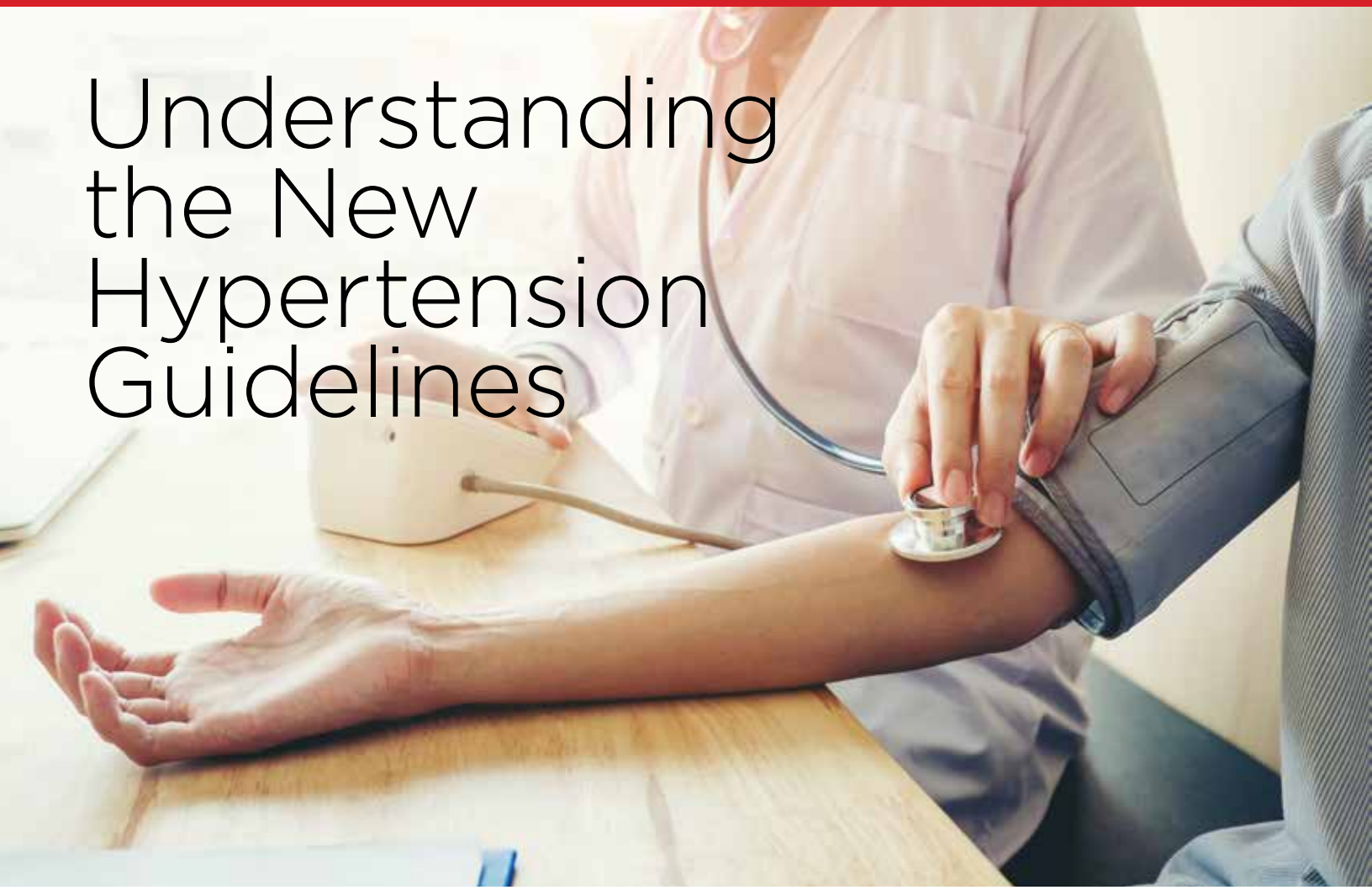
Understanding the New Hypertension Guidelines



By Wayne N. Leimbach, Jr., MD, FACC, FACP, FSCAI, FCCP, FAHA

Many people ask why new hypertension guidelines are needed. The rationale for the new hypertension guidelines is that in 2010 data showed that high blood pressure was the leading cause of death and disability adjusted life years worldwide.

In the United States, hypertension accounted for more cardiovascular deaths than any other modifiable cardiovascular risk factor. In addition, data from a meta-analysis of 42 trials involving 144,220 patients demonstrated a linear association between the mean achieved systolic blood pressure and the risk of cardiovascular mortality, with the lowest risk in the 120 mmHg to 124 mmHg group.

In addition, when the panel analyzed all the available information from multiple studies, the evidence showed that a lower blood pressure is better than a higher blood pressure, and that some patients will benefit from systolic blood pressure treatment that lowers blood pressure to less than 120 mmHg.

Most importantly, not only will more aggressive hypertension goals prevent heart attacks and strokes, it has been estimated that if new hypertension guidelines are implemented in United States, it would be possible to prevent greater than 20,000 deaths per year.

The new guidelines for the prevention, detection, evaluation and management of high blood pressure in adults was published by both the American College of Cardiology and American Heart Association in 2017.

Figure 1 lists the new categories for blood pressure in adults. It shows that a person is considered to have normal blood pressures when the systolic blood pressure is less than 120 mmHg and the diastolic blood pressure is less than 80 mmHg. It states that if a person's blood pressure is between 120 and 129 mmHg systolic and the diastolic blood pressure is still less than 80, then they have elevated blood pressures.

Under the new guidelines, if a person's blood pressure

Figure 1

Categories of BP in Adults*

BP Category	SBP		DBP
Normal	<120 mm Hg	and	<80 mm Hg
Elevated	120-129 mm Hg	and	<80 mm Hg
Hypertension			
Stage 1	130-139 mm Hg	or	80-89 mm Hg
Stage 2	≥140 mm Hg	or	≥90 mm Hg

*Individuals with SBP and DBP in two categories should be designated to the higher BP category.
BP indicates blood pressure (based on an average of ≥2 careful readings obtained on ≥2 occasions).

It has been estimated that if new hypertension guidelines are implemented in United States, it would be possible to prevent greater than 20,000 deaths per year.

is between 130 to 139 mmHg or the diastolic blood pressure is between 80 to 89 mmHg, then they have established stage I hypertension. If a person's systolic blood pressure is greater than 140 mmHg or diastolic greater than or equal to 90 mmHg, then the patient has stage II hypertension.

These guidelines are based upon an average of 2 or more blood pressure readings on 2 or more separate occasions. Prior to these guidelines, high blood pressure was defined as systolic blood pressures of 140 mmHg or greater or diastolic blood pressures of 90 mmHg or greater.

Based on the new guidelines, it means that 46% of the US population will be diagnosed with high blood pressure. For patients 65 years to 75 years of age, 77% of men will now be defined as having high blood pressure and 75% of women will have high blood pressure. For patients greater than 75 years of age, between 79% and 85% of US adults will now carry the diagnosis of high blood pressure.

Other changes in the guidelines include that healthcare providers are now supposed to screen for other cardiovascular disease risk factors in patients with hypertension. These are the modifiable risk factors which include: cigarette smoking or exposure to second hand smoke, diabetes mellitus, dyslipidemia, overweight/obesity, physical inactivity and an unhealthy diet. In addition, fixed risk factors that increase the risk of high blood pressure include chronic kidney disease, family history of cardiovascular disease, increased age, low socioeconomic and educational status, obstructive sleep apnea, psychosocial stress and male sex (Figure 2).

Figure 2

CVD Risk Factors Common in Patients with Hypertension

Modifiable Risk Factors	Relatively Fixed Risk Factors
• Current cigarette smoking, secondhand smoking • Diabetes mellitus • Dyslipidemia/hypercholesterolemia • Overweight/obesity • Physical inactivity/low fitness • Unhealthy diet	• CKD • Family history • Increased age • Low socioeconomic/educational status • Male sex • Obstructive sleep apnea • Psychosocial stress

Figure 3

BP Patterns Based on Office and Out-of-Office Measurements

	Office/Clinic/Healthcare Setting	Home/Non-healthcare/ ABPM Setting
Normotensive	No hypertension	No hypertension
Sustained hypertension	Hypertension	Hypertension
Masked hypertension	No hypertension	Hypertension
White coat hypertension	Hypertension	No hypertension

ABPM: ambulatory blood pressure monitoring BP: blood pressure

In addition, it is now recommended that blood pressure monitoring should include not only office blood pressure measurements, but also out of office blood pressure measurements at home. Based on the new guidelines, there are now 4 categories to define the patient's blood pressure. They are based on both the combination of office blood pressure measurements and home blood pressure measurements (Figure 3). Normotensive is now defined as no high blood pressure in the office and no high blood pressure at home. Sustained hypertension is defined as high blood pressure in the office and high blood pressure at home. These people are at the highest risk. There is now a category called masked hypertension where the patient's blood pressure is normal in the office, but is high at home. These

(continued on p. 20)

(continued from p. 19)

patients carry significant risk and should be treated.

The concept of white coat hypertension is defined by patients with high blood pressures in the office, but no high blood pressure at home. Data now clearly shows that these people still are at risk for the complications of high blood pressure and should be treated.

An article published in The New England Journal of Medicine on 04/19/2018 by Vanegas et al shows that in a registry study of 63,910 adults, 24 hour ambulatory blood pressure monitoring was a stronger predictor of mortality than blood pressure measurements in the clinic. In fact, masked hypertension (normal blood pressure in the clinic, but elevated ambulatory blood pressure) was associated with greater risk of death than sustained hypertension. In addition, white coat hypertension was not benign and was associated with increased risk of cardiovascular events.

The guidelines also recommend that patients with new onset high blood pressure, especially if they are of younger age, should be screened for secondary forms of hypertension, which are treatable. The patient should be considered for evaluation for renal parenchymal disease, renovascular disease, primary aldosteronism, obstructive sleep apnea and significant drug or alcohol-induced high blood pressure. Uncommon causes that need to be at least considered include pheochromocytoma, Cushing syndrome, hypothyroidism, hyperthyroidism, aortic coarctation, primary hyperparathyroidism, congenital adrenal hyperplasia, mineralocorticoid excess syndrome, and acromegaly (Figure 4).

Based on the new guidelines, it means that 46% of the US population will be diagnosed with high blood pressure.

For patients with the diagnosis of hypertension, nonpharmacologic interventions are indicated and the patient should be counseled on these. These include weight loss, heart healthy diet such as the DASH diet, sodium reduction, potassium supplementation (except in patients with kidney disease), increased physical activity, and reduction of alcohol intake to no more than 2 standard drinks per day for men and 1 standard drink per day for women.

Basic and optional testing for primary hypertension patients include blood work to test for fasting glucose, complete blood count, lipid profile, serum creatinine, electrolytes including serum sodium and potassium and calcium, thyroid stimulating hormone, urinalysis, and electrocardiogram. Optional testing would include echocardiogram, uric acid and urine albumin to creatinine ratio (Figure 5).

Because of the well-established risk for cardiovascular disease events seen with patients with hypertension, the new guidelines call for a much more aggressive approach to the treatment of hypertension. A level 1 recommendation by the guidelines is that "adults initiating a new or adjusted drug regimen for hypertension should have a follow up evaluation of adherence and response to treatment at monthly intervals until control was achieved."

Another major change in regards to the new guidelines includes the recommendation for initial medication choices. A level 1 guideline

Figure 4

Causes of Secondary Hypertension with Clinical Indications

Common Causes
• Renal parenchymal disease
• Renovascular disease
• Primary aldosteronism
• Obstructive sleep apnea
• Drug or alcohol induced
Uncommon Causes
• Pheochromocytoma/paraganglioma
• Cushing's syndrome
• Hypothyroidism
• Hyperthyroidism
• Aortic coarctation (undiagnosed or repaired)
• Primary hyperparathyroidism
• Congenital adrenal hyperplasia
• Mineralocorticoid excess syndromes other than primary aldosteronism
• Acromegaly

A heart healthy diet is one of many nonpharmacologic interventions that can be taken to reduce hypertension in patients.

is that for the initiation of antihypertensive drug therapy, first line agents include thiazide, diuretics, calcium channel blockers and ACE inhibitors or angiotensin receptor blockers. It should be noted that no beta-blockers are listed as first line therapy unless there is another indication for the use of beta-blockers. In addition, a major change in the guidelines includes the recommendation for the consideration of starting 2 first line agents of different classes when treating patients with systolic blood pressures of 140 mmHg or greater. In addition, it is recommended that the patient should be started on 2 first agents, which may be a fixed combination medication since they have been shown to improve compliance.

It should also be noted that in patients with ischemic heart disease, that guideline-directed medical therapy beta-blockers will be used as one of the first line medications. In addition, in patients with cardiomyopathy, a mineralocorticoid receptor antagonist should be considered.

The goals for initiating pharmacologic therapy are listed in Figure 6. It should be noted that for the majority of comorbidities such as diabetes, chronic kidney disease, heart failure, and stable ischemic heart disease, it is recommended that medications be initiated when systolic blood pressures are greater than 130/80 mmHg.

In summary, the new guidelines indicate a much more aggressive approach to treating blood pressures. The new guidelines now define high blood pressure as starting at 130 mmHg, as compared to 140 mmHg before. The guidelines define normal blood pressures as less than 120/80. The guidelines call for initiation of medical therapy (if lifestyle modification fails) for blood pressures of 130/80 or greater in most patients who have any comorbidities. The new guidelines call for an aggressive approach to treating high blood pressure, such that patients are managed more frequently until they hit target levels. In addition, the new guidelines now emphasize the use of office blood pressure measurements and home blood pressure measurements. Finally, the guidelines now indicate therapy should be initiated not only for high blood pressures in the office, but also for high blood pressures at home and for patients who have white coat syndrome.

The reason behind the new guidelines is that a dramatic number of heart attacks, strokes and cardiovascular deaths could be prevented each year in the United States by adoption of these new guidelines.

For those interested in more information, the guidelines can be found on the website for the American Heart Association and the website for the American College of Cardiology.

Figure 5

Basic and Optional Laboratory Tests for Primary Hypertension

Basic testing	• Fasting blood glucose* • Complete blood count • Lipid profile • Serum creatinine with eGFR* • Serum sodium, potassium, calcium* • Thyroid-stimulating hormone • Urinalysis • Electrocardiogram
Optional testing	• Echocardiogram • Uric acid • Urinary albumin to creatinine ratio

*May be included in a comprehensive metabolic panel.
eGFR indicates estimated glomerular filtration rate.

Figure 6

BP Thresholds for and Goals of Pharmacological Therapy in Patients with Hypertension According to Clinical Conditions

	BP Threshold, mm Hg	BP Goal, mm Hg
General		
Clinical CVD or 10-year ASCVD risk ≥10%	≥130/80	≥130/80
No clinical CVD and 10-year ASCVD risk <10%	≥140/90	≥140/90
Older persons (≥65 years of age; noninstitutionalized, ambulatory, community-living adults)	≥130 (SBP)	≥130 (SBP)
Specific comorbidities		
Diabetes mellitus	≥130/80	<130/80
Chronic kidney disease	≥130/80	<130/80
Chronic kidney disease after renal transplantation	≥130/80	<130/80
Heart failure	≥130/80	<130/80
Stable ischemic heart disease	≥130/80	<130/80
Secondary stroke prevention	≥140/90	<130/80
Secondary stroke prevention (lacunar)	≥130/80	<130/80
Peripheral arterial disease	≥130/80	<130/80

ASCVD: atherosclerotic cardiovascular disease
CVD: cardiovascular disease
BP: blood pressure
SBP: systolic blood pressure

Dr. Leimbach is a specialist in interventional and structural cardiology, including cardiac catheterization, coronary angioplasty, stents, atherectomy, laser, intravascular ultrasound imaging, and direct PTCA/stents for acute myocardial infarction. He also specializes in percutaneous closure of PFOs, ASDs, PDAs and percutaneous valve replacement or repair procedures such as TAVR and MitraClip. He is Director of the Cardiac and Interventional Laboratories at Oklahoma Heart Institute Hospital. Dr. Leimbach is Co-Founder of the Lipid and Wellness Clinic at Oklahoma Heart Institute. He is Director of the James D. Harvey Center for Cardiovascular Research at Hillcrest Medical Center, as well as Director of the Oklahoma Heart Research and Education Foundation. He serves as Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine-Tulsa.

ICE CREAM SUNDAE PIE Serves 12

Fresh cherries are the crowning feature in this rich, picturesque pie. For a less-sweet crust, combine 1 cup graham cracker crumbs, 1/4 cup ground flaxseed and 3 tablespoons melted butter.

1 teaspoon unsalted butter, plus 3 tablespoons, melted and divided

16 chocolate sandwich cookies, crushed

4 cups vanilla ice cream, softened

1/2 cup strawberry fruit spread

1/2 cup toasted walnut pieces

1 1/2 cup whipped topping

1/4 cup dark chocolate mini chunks or chips

12 fresh cherries

Use 1 teaspoon butter to butter a 9-inch pie pan. Combine cookies and 3 tablespoons butter in a bowl then press firmly into pan to form a crust; chill 30 minutes.

In a bowl, stir ice cream until spreadable then transfer half into crust and gently spread to cover bottom. Dollop fruit spread over ice cream then scatter with walnuts. Spoon remaining ice cream over walnuts and gently spread to edges. Spread whipped topping over the top, garnish with chocolate chunks, cover and freeze until firm, 4 to 6 hours. Garnish with cherries, briefly set the pan in warm water to loosen crust, slice and serve.

NO-COOK ZUCCHINI "NOODLE" SALAD

Serves 8

Thinly sliced summer squash fills in as a flavorful no-cook pasta salad at your next cookout or picnic. Enjoy with grilled sausages, on a grilled chicken sandwich or over a bed of mixed greens.

3 tablespoons extra-virgin olive oil

2 tablespoons white wine vinegar

2 tablespoons minced fresh marjoram or oregano

3/4 teaspoon fine sea salt

1/4 teaspoon ground black pepper

2 pounds zucchini and/or yellow summer squash

1 (4-ounce) jar pimientos, drained

In a large bowl, whisk together oil, vinegar, marjoram, salt and pepper until blended.

Using a vegetable peeler or mandolin, cut squash lengthwise into long, thin "noodles." Rotate squash as you peel and discard seedy core. Add squash to dressing in the bowl along with pimientos and toss to combine. Serve immediately or let marinate up to 15 minutes.

SPICY GRILLED SHRIMP KABOBS

Serves 6

A quick sauce made in the food processor doubles as a marinade and a dressing for this delicious grilled entrée. Removing the seeds from the jalapeño peppers should leave your dish with a pleasant heat; for a fiery version, keep the seeds in one of the peppers.

1 bunch fresh cilantro, tough stems removed, divided

1/4 cup extra-virgin olive oil

2 jalapeño peppers, seeded

3 tablespoons lemon juice

3/4 teaspoon coarse sea salt

2 pounds extra-large shrimp, peeled and deveined

Set 6 sprigs cilantro aside for garnish. Combine remaining cilantro, oil, jalapeños, lemon juice and salt in a food processor and process until finely chopped, scraping down the sides of the bowl as needed. If sauce is very thick, with the machine running, pour in water, 1 tablespoon at a time, until sauce is pourable.

In a large bowl, toss together shrimp and half of the sauce. Let sit at room temperature for 20 minutes.

Prepare a grill for medium-high heat cooking. Thread shrimp onto metal skewers. (If using wooden skewers, soak in water for 30 minutes before assembling.) Grill, turning once, until shrimp are just opaque in center, about 6 minutes total. Transfer to a platter, garnish with reserved cilantro and serve remaining sauce on the side.

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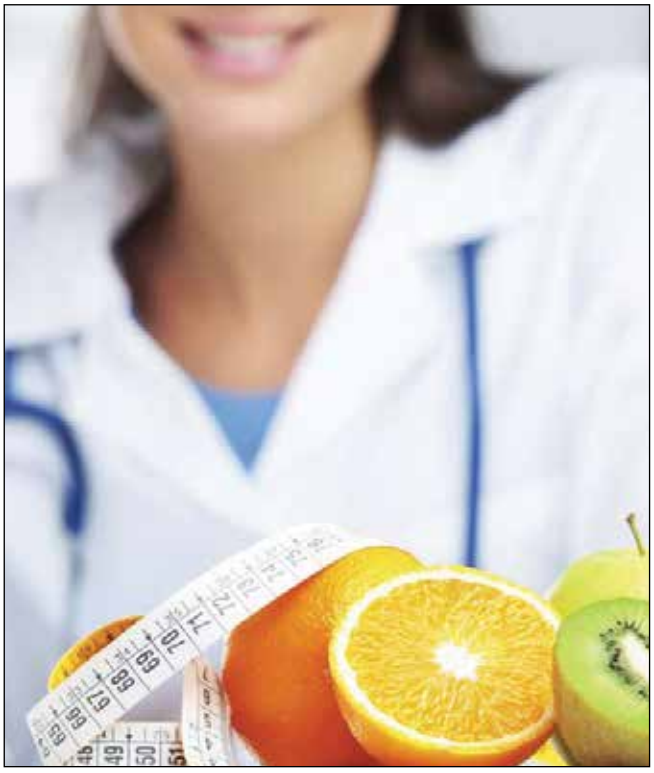

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