MAYO CLINIC

ClinicalUpdate

Current Trends in the Practice of Medicine

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INSIDE THIS ISSUE

The Role of Ankle Arthroplasty in Treating End-Stage Ankle Arthritis

Management of patients with symptomatic ankle arthritis is challenging. Use of total ankle arthroplasty for debilitating end-stage ankle arthritis is expanding as implant design and technique have steadily improved over the past 20 years. Interest in arthroplasty has also been renewed by concerns that arthrodesis, the traditional treatment modality, may contribute to progression of arthritis in adjacent joints due to transmission of increased stress.

However, long-term effectiveness data on modern ankle arthroplasty are not yet available for several reasons. One is the lack of uniform outcome measures to apply to clinical results. Another is the variation in mobile-bearing and fixed-bearing prostheses. Generalizations are therefore difficult to make. But recent prospective controlled trials, meta-analyses, and experience suggest that when the latest prostheses, instrumentation, and techniques are employed, total ankle arthroplasty can offer equivalent pain relief—and perhaps even better function due to increased range of motion—than ankle arthrodesis.

Patient Selection and Education

Patient selection and education, along with physician expertise and experience from a high-volume foot and ankle practice, remain cornerstones of consistent success with arthroplasty in terms of functional outcomes and revision-free implant survival. According to Mayo Clinic orthopedic surgeons, carefully considering and fitting the selection criteria for ankle replacement to each patient individually are the keys to achieving the best possible outcomes with total ankle arthroplasty.

Ankles have unique physiologic and mechanical attributes that complicate arthroplasty. One of the first tasks of the consulting foot and ankle surgeon often is

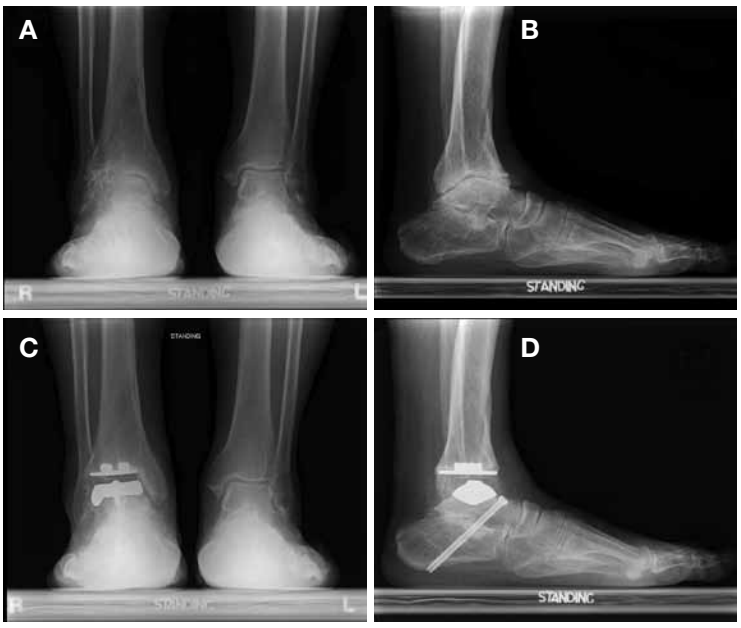


Figure. *A and B, Preoperative radiographs of the ankle showing osteoarthritis degeneration. C and D, Postoperative radiographs showing good alignment of total ankle implants.*

to explain the unique character of the ankle joint to patients. A range of treatment options exists, and it's important to choose the treatment that best suits each patient's needs (Figure on page 1).

The Treatment Continuum

The most common causes of ankle arthritis are trauma and abnormal mechanics that produce pain, inflammation, impaired mobility, and ankle instability. Nonoperative treatment modalities include physical therapy and anti-inflammatory medications, bracing, modifying footwear, immobilization, behavior changes such as switching to low-impact activities or sports, weight loss in the case of obese patients, and joint injections.

When pain remains debilitating and conservative measures have failed to treat end-stage ankle arthritis, surgical options include arthroscopic or open debridement of chondral defects; impinging osteophytes and loose bodies; ankle arthrodesis through varying techniques; and arthroplasty. First developed more than 40 years ago, ankle arthroplasty has improved as it has evolved, particularly in terms of refinements in hardware design and fabrication, instrumentation, implant positioning technique, and reconstructive benefits to the hindfoot.

Indications and Contraindications

No standard clinical indications have been formulated. In general, primary indications for total ankle arthroplasty are degenerative, posttraumatic, and rheumatoid arthritis.

Experienced specialists tend to consider arthroplasty for patients with

- Advanced, debilitating ankle arthritis
- Joint surfaces destroyed by trauma, scarring, or deformity
- Pain and impairment so severe that daily life tasks are interrupted

Arthroplasty is contraindicated for patients with recent infections and serious comorbidities such as vascular impairment; severe joint laxity; compromised soft-tissue envelope; neuropathic joint disease; avascular necrosis of the talus; and severe deformities of the ankle.

Points to Remember

- When pain remains debilitating and conservative measures have failed to treat end-stage ankle arthritis, surgical options include arthroscopic or open debridement, ankle arthrodesis, and arthroplasty.
- Recent prospective controlled trials, meta-analyses, and experience suggest that when the latest prostheses, instrumentation, and techniques are employed, total ankle arthroplasty can offer equivalent pain relief—and perhaps even better function due to increased range of motion—than ankle arthrodesis.
- Mayo Clinic orthopedists note that careful patient selection and education about the risks, benefits, and current outcomes associated with ankle arthroplasty are important.

Evaluation and Rehabilitation

Evaluation starts with a thorough medical and orthopedic evaluation of the patient. This includes gait analysis and weight-bearing x-ray imaging, and possibly CT, MRI, and bone scans. Obtaining a complete understanding of lifestyle factors and medical history is also important because these factors can impact the implant's durability and performance and a patient's likelihood to comply with a rehabilitation program.

The postoperative rehabilitation of ankle arthroplasty patients is a period of non–weight-bearing and cast immobilization for several weeks. If the soft tissue structures have been balanced during the surgery and the intraoperative range of motion was satisfactory, physical therapy is usually not required to achieve range of motion. Patients can usually start bearing weight at 6 weeks after surgery and progress to normal activities over the ensuing month.

Elements of Success

Elements of successful ankle arthroplasty include

- Adequate amount and quality of soft tissue
- Potential for correct biomechanical alignment
- Lifestyle that supports compatible activities postoperatively, given that the ankle is subjected to high weight-bearing force per unit area
- Multidisciplinary depth to aid wound-healing, rehabilitation, recovery, and continuity of care
- Scrupulous surgical technique to minimize chance of deep infection
- Careful patient selection and education about the risks, benefits, and current outcomes associated with ankle arthroplasty

Concussion: Determining When the Brain Has Recovered

A sudden stop, a blow to the body, or a sharp twist of the head may make an athlete feel momentarily dazed, dizzy, or nauseated. Typically, the athlete would play through these symptoms or return to play as soon as he or she felt better. Yet, days and months later, that same athlete could be plagued by headaches, difficulty concentrating and mood swings.

Mental exertion or a return too early to physical activity before a brain injury is resolved can worsen symptoms and puts athletes at increased risk for repeat injury with potentially permanent neurologic consequences. Until fully recovered, the brain is in crisis. Injured again, the crisis could turn life-threatening. Second-impact syndrome, a rare but usually fatal syndrome predominantly affecting young male athletes under the age of 18 years, is a devastating consequence of returning athletes to play before complete recovery.

Determining when the brain has fully recovered is critical to the long-term brain health and even survival of someone who has sustained an initial concussion. Neurologists, psychologists, and sports medicine physicians at Mayo Clinic are actively involved in learning more about these issues. In addition, these Mayo specialists offer consultations, including baseline and after-injury neuropsychological testing, and follow-up care.

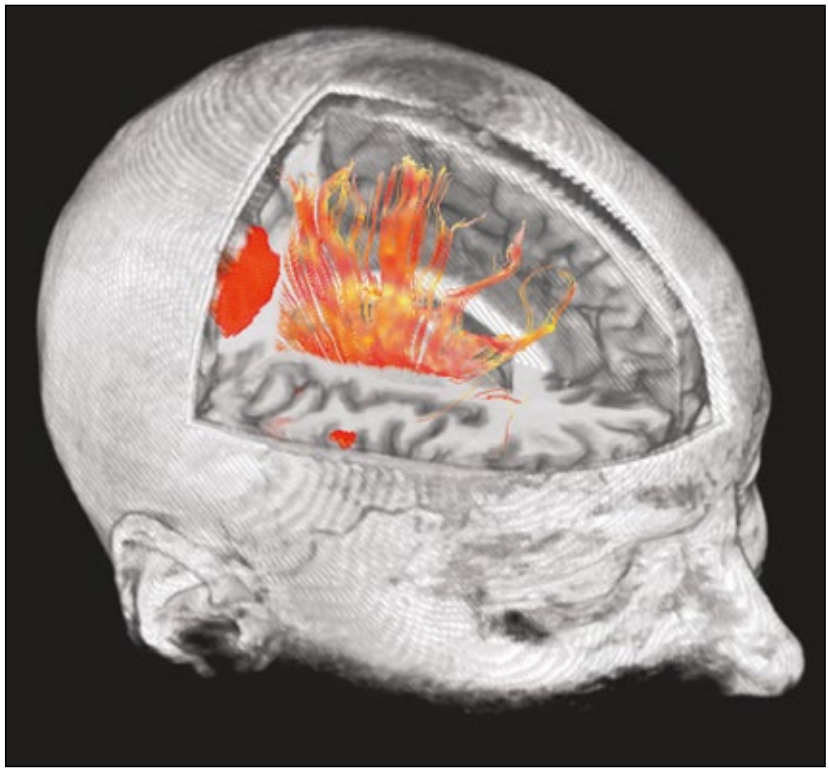
Points to Remember

- Most sports-related concussions are never diagnosed because athletes may not recognize or report the symptoms of concussion.
- Annually, at least 3.8 million children and adults in the United States experience a sports-related concussion.
- Among people who are 15 to 24 years old, sports are second only to motor vehicle crashes as the leading cause of traumatic brain injury.

Baseline Cognitive Testing

In the face of heightened public concern about concussion, many states have legislated that athletes recognized as experiencing a concussion be immediately removed from play and not allowed to return to play until evaluated and cleared by a licensed health care provider. However, without an objective measure of the athlete's baseline cognitive function, such diagnostic decisions are difficult even for those providers with expertise in dealing with brain injury. Results of the neurologic examination may be normal. Standard imaging, such as CT and MRI of the brain, lacks the resolution to show microscopic structural and metabolic changes in the recovering brain. And the subjective assessment of athletes, many of whom do not recognize the connection between their symptoms and a concussion or fail to report their symptoms in the interest of returning to their sport, can be unreliable.

Cognitive testing is often the only viable and objective measure of impairment and recovery. To be effective, however, the results must be measured against an individual's preinjury baseline. Administered online, the cognitive baseline and after-injury test takes about 10 minutes to complete. It assesses skills such as memory, attention, learning, reaction time, and processing speed. Students can share the results



with coaches, athletic trainers, and the health care provider of their choice.

Educating athletes, coaches, parents, and athletic trainers about the symptoms, signs, and potential long-term effects of concussion and repeated concussion is critically important. Preventing concussion is as important as detecting it. According to Mayo Clinic neurologists, while advances in helmets and protective equipment are important, their capacity to prevent concussion is limited. Emphasizing the importance of mutual respect among players, eliminating head hits and fighting, and teaching young athletes involved in collision sports how to deliver and absorb a body check or tackle will help reduce the frequency of concussion.

Children are particularly vulnerable to concussion. The developmental and maturational changes that occur in the brains of children appear to render them vulnerable to concussion, with symptoms that may take longer to resolve. In addition, concussions are more frequent in female athletes than male athletes, possibly because of their smaller neck girth, which does not provide the stability required to prevent the angular or rotational acceleration of the head that is a common mechanism of concussion.

Mayo neurologists also stress that injured brains need rest—both cognitive and physical. Recovery typically takes more time in a child than in an adult. Not only is the developing brain more susceptible to injury, but an injury of similar magnitude has a greater impact on a 12-year-old child than a 28-year-old adult. Repeated concussive injury can affect cognitive development, with consequences for learning and future employment. The concussed brain is a brain in crisis, and even a return to cognitive activities at school can stress the brain, amplify symptoms, and prolong recovery.

Clinical researchers at Mayo Clinic in Arizona and Minnesota have launched a prospective study in Junior A League hockey players to evaluate the correlation among clinical, imaging, and serum biomarkers and in-helmet g-force measurements and outcomes following concussion. Mayo researchers are also developing research protocols to validate rapid screening and diagnostic tools for diagnosing concussion; evaluate the cellular pathophysiology of concussion; identify clinical, imaging, or neurophysiologic biomarkers that are diagnostic for concussion; and identify risk factors and prediction models for people at risk for long-term neurologic sequelae (eg, dementia, stroke, and psychiatric disease).

New Protocols Allow for MRI in Selected Pacemaker Patients

The use of implantable pacemakers and cardioverter-defibrillators (ICDs) has increased dramatically, due in part to the aging of society and expanded indications for their use. An estimated 75% of patients who currently have an implantable cardiac electronic device will need MRI during their lifetimes. In the past, MRI was contraindicated in all patients with implantable cardiac devices because of concerns that the powerful magnetic and radiofrequency fields generated during imaging might damage device components, inhibit pacemaker function, cause heat at the lead tip, trigger rapid pacing, or deliver inappropriate shocks.

In recent years, several centers have begun offering MRI to patients with cardiac pacemakers. However, the current guidelines from the American Heart Association and the US Food and Drug Administration (FDA) do not support MRI in pacemaker patients, nor do any of the device manufacturers (except for new MRI-conditional devices).

The American College of Radiology recognizes that MRI in pacemaker patients is never routine and should be conducted only when the case is properly triaged and deemed medically necessary and when alternative radiologic methods have been considered and determined not to be

Points to Remember

- Recent studies have suggested that magnetic resonance imaging can be done safely in many patients with standard cardiac pacemakers, providing they are not pacemaker-dependent.
- A new MRI-conditional pacemaker and lead system permits selected examinations in both pacemaker-dependent and pacemaker–non–dependent patients.
- MRI should not be performed if there is evidence of generator or lead malfunction.

diagnostic. Also, the college stipulates that there should be cardiology pacemaker support and careful pacemaker and physiologic monitoring during the MRI, as well as MRI physicist support during imaging.

The first MRI-conditional pacemaker system received FDA approval for use in the United States in February 2011 (Revo MRI SureScan, Medtronic). This first-generation device has important limitations. It requires a special lead system, so the generator cannot be simply replaced and connected to in situ intracardiac leads. Cardiac MRI is excluded because of potential overheating of the new lead system. (Second-generation devices currently available in Europe use a lead system that is compatible with cardiac MRI.) Also, the first-generation devices are limited to 1.5-Tesla scanners.

While it is likely that MRI-conditional pacemakers and possibly ICDs will become standard in the next decade, there is a large population of patients who in the interim may require MRI scanning. Recent studies have suggested that MRI can be done safely in many patients with standard cardiac pacemakers, providing they are not pacemaker-dependent.

Mayo Researchers Launch Pilot Protocol

Physicians from the Department of Radiology and the electrophysiology group in the Division of Cardiovascular Diseases at Mayo Clinic in Minnesota, Arizona, and Florida have devised a pilot protocol for patients with standard pacemakers in whom MRI is being considered. These cases are triaged by a radiologist to assess whether alternative radiologic tests exist that could answer the clinical question with equal utility. For example, tailored CT and ultrasonography can sometimes provide the needed diagnostic information and eliminate the need for MRI. However, in other cases, especially after obtaining alternative examinations, MRI becomes the imaging modality of choice.

The device is then interrogated in cardiology, and prospective patients meet with a member of the Heart Rhythm Services team to determine whether the patient is pacemaker-dependent and the relative need for pacing under baseline conditions. In patients with non–MRI-conditional devices, only nondependent patients with mature lead systems are considered. Patients with devices that demonstrate inadequate function (eg, high capture threshold, high pacing impedance, depleted battery voltage) are excluded. Although only head MRI was performed initially in the pilot protocol, body scanning was later allowed.

According to the protocol, the pacemaker is programmed in an asynchronous mode at the intrinsic heart rate plus 20 beats per minute prior to scanning. Patients are supervised by a cardiologist or pacemaker nurse through the procedure. Pulse oximetry and ECG are monitored. The device is then reprogrammed to original settings after the scan is complete.

The MRI pulse sequences are determined by the radiologist, MR technologist, and physicist. All protocol examinations take place on a 1.5-Tesla magnet, and the specific RF power absorption rate is limited to 1.5 W/kg or less. If prescan sequences demonstrate heart rate synchronization to the pulse sequence repetition time, the scan is discontinued.

Preliminary Findings

To date, no clinically adverse events have been noted. "Power-on" resetting (POR) and magnet mode pacing have been observed in some patients and seem to be device-specific. Premature ventricular contractions have been observed, but they have been clinically insignificant. Lead model has not been predictive of abnormal pacing function during MRI studies, nor has region of the body scanned. All pacing abnormalities appear to have been transient and reversible. No effects on generator voltage or lead function have been observed either immediately after scanning or at 1-month follow-up.

During POR, battery voltage declines to less than a critical preset level (the trip level) at which point operation of the device is unpredictable. After recovery of battery voltage, devices typically reset to the manufacturer's nominal settings. These resets require removal of the patient from the MRI scanning room and analysis by heart rhythm services before further imaging can be considered.

Magnet mode pacing occurs as a result of reed-switch activation by the magnetic field generated during MRI. Theoretically, programming the device to an asynchronous mode should prevent reversion; however, magnet mode pacing has been seen during scanning, despite asynchronous programming, and could initiate arrhythmias.

The Centers for Medicare and Medicaid Services have approved reimbursement for MRI for patients with the new MRI-conditional pacing system. However, per Medicare's National Coverage Determination, MRIs performed in patients with other pacemaker systems may not be covered.

Bevacizumab Expands Treatment Options for Patients With Age-Related Macular Degeneration

Two-year results from a National Eye Institute–funded study of neovascular age-related macular degeneration (AMD) treatments indicate that bevacizumab (Avastin), a drug commonly used off-label to treat new blood vessel growth due to wet AMD, is as effective as ranibizumab (Lucentis) for the treatment of AMD when given at the same dosing schedule.

Researchers participating in the Comparison of AMD Treatments Trials (CATT) report that bevacizumab and ranibizumab are equally effective in halting eye damage that leads to blindness. Bevacizumab costs approximately $50 per treatment. Ranibizumab, the US Food and Drug Administration–approved treatment for wet AMD, costs $2,000.

The Mayo Clinic Department of Ophthalmology is one of the major centers participating in CATT. The study's principal investigator at Mayo Clinic says that, based on 2-year results, patients at Mayo Clinic will be given the choice of either drug. However, subgroup analyses being performed by the CATT group may confirm whether patients with specific lesion types respond better to one drug vs the other.

Points to Remember

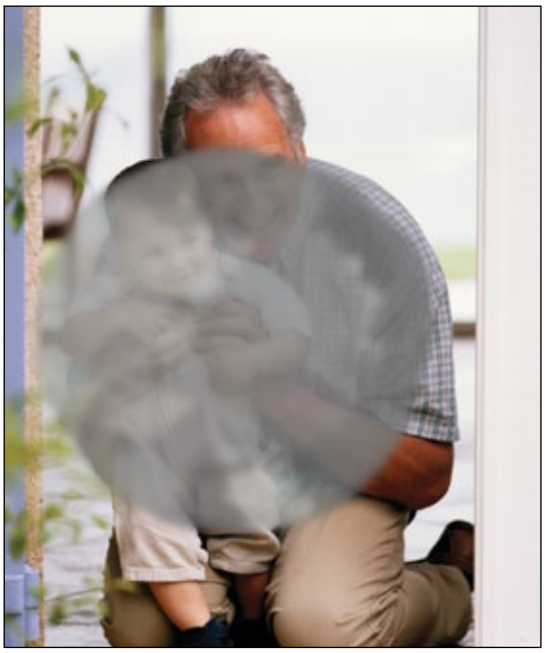
- Age-related macular degeneration (AMD) is the leading cause of vision loss and blindness in older Americans.
- The Mayo Clinic Department of Ophthalmology is participating in Comparison of AMD Treatments Trials (CATT), a multicenter trial comparing 2 AMD treatments: bevacizumab (Avastin) and ranibizumab (Lucentis).
- Two-year results from CATT indicate that bevacizumab and ranibizumab are equally effective in halting eye damage that leads to blindness.

CATT Compares Drugs and Dosing

CATT investigators compared the effects of both drugs and of 2 different dosing regimens: monthly use vs an as-needed regimen. Results show that monthly use of either bevacizumab or ranibizumab results in the same visual acuity

Physician Update

An e-mail newsletter and a physician video blog. Visit www.mayoclinic.org/medicalprofs for more details.



outcome, the primary outcome measure for CATT. Researchers also compared the visual-acuity outcomes associated with both the monthly and the as-needed regimens of ranibizumab. Most of the change in mean visual acuity occurred during year 1. At 2 years, the mean increase in letters of visual acuity from baseline was 8.8 in the ranibizumab-monthly group, 7.8 in the bevacizumab-monthly group, 6.7 in the ranibizumab-as-needed group, and 5.0 in the bevacizumab-as-needed group.

Two-year results also indicated no differences between drugs in rates of death or arteriothrombotic events. Higher rates of serious adverse events with bevacizumab were noted, but the importance of these data is unclear because of the lack of specificity to conditions associated with inhibition of vascular endothelial growth factor.

CATT demonstrates that the less expensive drug is a viable treatment. These trial results allow physicians to offer more choices to patients with AMD and help them to make better-informed decisions about their treatment options.

Learn More About CATT

Visit www.clinicaltrials.gov (NCT00593450) or contact the Mayo Clinic clinical trials office at 507-538-7623.

Read about CATT in the May 19, 2011, issue of the *New England Journal of Medicine* at www.nejm.org.

View video of ophthalmologist Sophie J. Bakri, MD, the CATT principal investigator at Mayo Clinic, discussing macular degeneration on YouTube at www.youtube.com/watch?v=WshDlMKs7W8.

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Medical Editor:
Scott C. Litin, MD

Editorial Board:
Robert P. Shannon, MD
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Education Opportunities

Case-Based Clinical Hematology and Oncology 2013: The 10th Annual Review

January 18-20, 2013, Westin Kierland Resort, Scottsdale, Arizona

This course will be a comprehensive update of issues in hematologic and oncologic malignancies presenting new disease classification, treatment, and challenging cases. Course topics will include updates from the American Society of Hematology (ASH) annual meeting and in medical oncology. Topics focus on key hematologic diseases (dysproteinemias, acute and chronic leukemias, lymphomas), key solid tumors (breast, thoracic, GI, GU), and overlap topics of supportive, ancillary and diagnostic care.

25th Annual Selected Topics in Internal Medicine

January 28-February 1, 2013, The Fairmont Orchid, Big Island, Hawaii

Selected Topics in Internal Medicine is a postgraduate course designed to update general internists, internist-subspecialists, family medicine physicians, and other primary health care providers on selected internal medicine topics. Some of the most common problems encountered in clinical practice will be represented. Presentations will be made by experts from various disciplines in internal medicine. Faculty members will be available during the break sessions to answer questions and to discuss cases with course participants.

9th Annual Mayo Clinic Women's Health Update

March 7-9, 2013, Firesky Resort, Scottsdale, Arizona

This annual course addresses the unique needs of female patients and their health care providers. Participants gain a comprehensive insight into relevant medical problems uniquely found in women, as well as a basic approach to addressing and improving common health concerns. An optional session featuring the latest on bioidentical hormones is also offered.

Internal Medicine Recertification Course

March 13-16, 2013, Hilton Waterfront Beach Resort, Huntington Beach, California

Mayo Clinic, in collaboration with Kaiser Permanente, will be offering an intensive recertification course. The course, which includes faculty from both Mayo Clinic and Kaiser Permanente, is designed to provide a comprehensive overview of all areas in internal medicine for practicing physicians. This unique course gives attendees the opportunity to earn up to 60 Maintenance of Certification (MOC) points, through an excellent collaborative learning experience.

Pain Medicine for the Non-Pain Specialist

March 14-16, 2013, Marco Island, Florida

This multidisciplinary course will target the integration of pain services across disciplines to address the national and international movement toward improved pain control in acute, chronic, and cancer pain populations.

Heart Failure Management for Nurse Practitioners, Physician Assistants, and Primary Care Providers

March 17-19, 2013, San Antonio, Texas

Using a case-based approach, this course will enhance the attendees' confidence in caring for these challenging patients. Heart failure is a devastating disease that causes debilitating symptoms and excess mortality. Nurse practitioners, physician assistants, and primary care providers play a pivotal role in the care of these patients. It is essential that heart failure is recognized promptly and proven therapies are applied to manage this chronic disease.

34th Annual Practice of Internal Medicine

April 29-May 3, 2013, Rochester, Minnesota

This course will focus on the management of a variety of medical issues seen in areas of gastroenterology, infectious diseases, general internal medicine, rheumatology, geriatrics, emergency medicine, pulmonary, endocrinology, cardiology, neurology, and women's health.

For additional information or to register, phone 800-323-2688 or visit www.mayo.edu/cme.

MAYO CLINIC | mayoclinic.org

4500 San Pablo Road
Jacksonville, FL 32224

200 First Street SW
Rochester, MN 55905

13400 East Shea Boulevard
Scottsdale, AZ 85259