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Preventing Sudden Cardiac Arrest and Sudden Cardiac Death: Indications for Implantable Defibrillators

Sudden cardiac arrest (SCA) is the leading cause of death in the United States and is fatal in 95% of cases. Even in the best emergency medicine services/early defibrillation programs, it is difficult to achieve high survival rates, often because SCA events are not witnessed and responders are unable to reach victims in time for successful resuscitation. Improving survival among patients who experience SCA is an important effort, but focusing on preventing SCA in high-risk patients could have a greater impact on overall survivorship.

Sudden Cardiac Death Risk Factors

Although SCA is the first presentation of cardiac disease in 20% to 25% of patients, most cases occur in patients with clinically recognized heart disease. According to the American Heart Association, the

risk of SCA among patients after myocardial infarction (MI) is 4 to 6 times greater than that of the general population. And reduced left ventricular ejection fraction (LVEF) remains the single most important risk factor for overall mortality and sudden cardiac death.

Points to Remember

- Key risk factors for sudden cardiac arrest are history of coronary heart disease or prior myocardial infarction and reduced left ventricular ejection fraction (LVEF), or a history of sustained ventricular arrhythmias.
- The implantable cardioverter-defibrillator (ICD) is the treatment of choice for patients with sustained ventricular arrhythmias or out-of-hospital cardiac arrest survivors except when the arrhythmias are caused by transient reversible and/or treatable conditions.
- Prophylactic ICD placement is indicated in patients with ischemic cardiomyopathy and an LVEF of 30% or less and in patients with dilated or ischemic cardiomyopathy with an LVEF of 35% and class II-III congestive heart failure.
- Prophylactic ICD placement is also indicated in patients with syncope of undetermined origin with clinically relevant, hemodynamically significant sustained ventricular tachycardia or ventricular fibrillation induced at electrophysiology study.

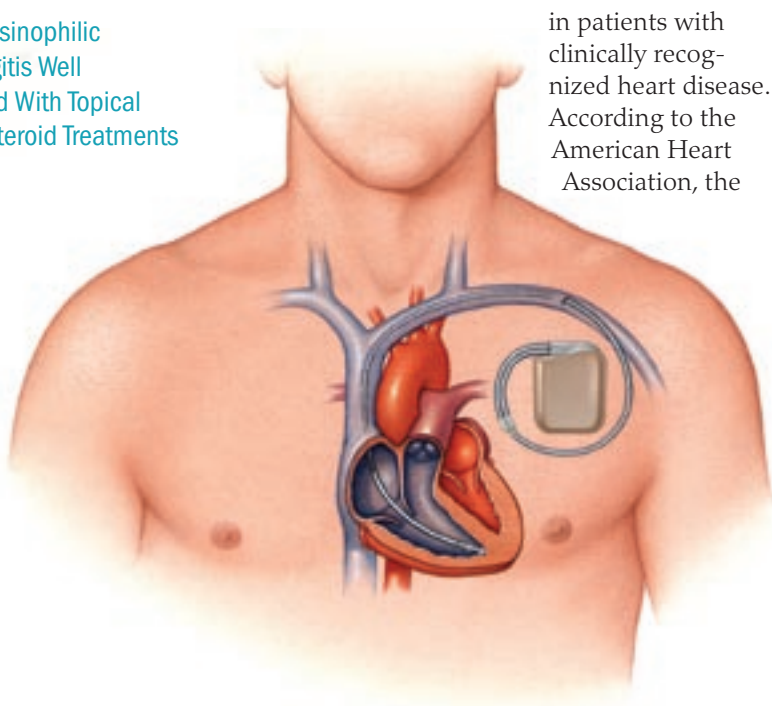


Figure 1. The implantable cardioverter-defibrillator (ICD) is the treatment of choice for patients with sustained ventricular arrhythmias or out-of-hospital cardiac arrest survivors, except when the arrhythmias are caused by transient reversible or treatable conditions.

Multicenter Automatic Defibrillator Implantation Trial II (MADIT II)

- Showed that ICDs yield better survival rates than conventional therapy in patients with ischemic heart disease and reduced LVEF of 30% or less.
- Suggested that ICD benefit increases over time.
- Showed relative mortality reduction (31%) and absolute mortality reduction (5.6%) among patients who received ICD therapy.

Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT)

- Focused on patients with class II or III congestive heart failure symptoms, no history of cardiac arrest, and ejection fraction of 35% or less, including patients with both nonischemic and ischemic cardiomyopathy.
- Showed that amiodarone has no favorable effect on survival and that ICD therapy reduces the relative risk of overall mortality by 23% and the absolute risk by 6% to 7%.

Primary vs Secondary Prevention ICDs

Since their introduction to clinical use in 1980, implantable cardioverter-defibrillators (ICDs) have been indicated for cardiac arrest survivors. In this secondary prevention role, ICDs shock

or pace the heart out of ventricular arrhythmias, abort recurrent SCA, and reduce all-cause mortality by about one-third. Extending the use of ICDs from secondary to primary prevention of arrhythmic death has been the subject of several trials in recent years (sidebar).

Mayo Clinic's SCA Prevention Initiative

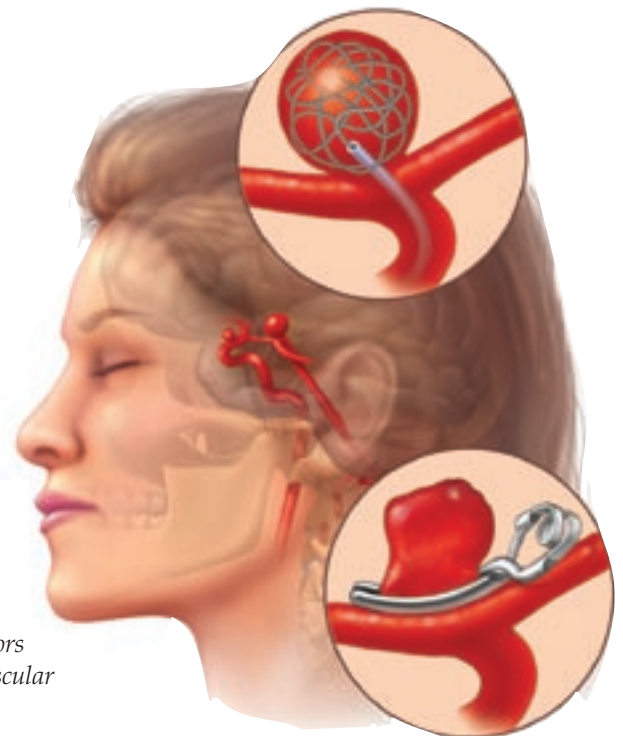
Despite the abundance of clinical evidence supporting ICD therapy for both primary and secondary prevention of SCA, published literature shows a low utilization of ICDs in patients who might benefit from this therapy (Figure). To address this challenge, Mayo Clinic cardiologists have developed a new system to identify patients at risk for SCA and to provide them with information about risk stratification and treatment options.

Mayo Clinic's Sudden Cardiac Arrest Prevention Initiative identifies and screens patients with LVEF of 35%. The patient information reviewed includes date of prior MI, date of initial diagnosis of nonischemic cardiomyopathy, date of prior percutaneous coronary intervention or coronary bypass surgery, whether an ICD has been placed, whether SCA risk has been discussed with the patient, and a number of other clinical parameters. After this process is completed, if a patient appears at risk for SCA, Mayo cardiologists send a letter to the patient's primary physician, detailing the issue at hand and the mechanism by which consultation for ICD consideration can be arranged.

Small Unruptured Intracranial Aneurysms: Recent Research Yields New Treatment Recommendations

As brain imaging improves, small, asymptomatic, unruptured intracranial aneurysms (UIAs) are identified with increasing frequency, often as incidental findings. Treatment for small UIAs may

Figure 1. *Interventional treatment options. Management options for brain aneurysms include conservative management with control of risk factors or an interventional treatment with either endovascular coiling or surgical clipping, as shown in the figure.*



include surgical intervention (craniotomy and clipping of the aneurysm), endovascular coiling, or observation, with lifestyle changes and risk factor modification such as blood pressure control and smoking cessation (Figure 1).

Determining which course of management is best for each patient continues to be a controversial subject. In many patients, the discovery of an aneurysm causes considerable anxiety, and some patients fear any type of intervention. Although the technology to fix the vast majority of small UIAs exists, distinguishing between UIAs that will rupture and those that will not is difficult. Factors that influence the decision about whether to intervene include the site, size, and shape of the UIA; the patient's age and medical and family history; and the relative risks and benefits of intervention vs management through observation.

Research Findings

Led by Mayo Clinic in Rochester, Minnesota, the International Study of Unruptured Intracranial Aneurysms (ISUIA) set out to shed light on the issue. The largest study of its kind, the first phases assessed the natural history and management outcomes of UIAs in more than 5,500 patients. The study examined surgical clipping, endovascular coiling, and observation. Among the many findings was that size and location mattered relative to risk for rupture: the smaller the aneurysm, the lower the risk of rupture. In asymptomatic patients without a

Points to Remember

- Small, asymptomatic, unruptured intracranial aneurysms (UIAs) are identified with increasing frequency, often as incidental findings.
- Management options for UIAs include control of risk factors or interventional treatment with either endovascular coiling or surgical clipping.
- The rupture risk of UIAs is dependent on aneurysm size and location. The smallest aneurysms have the lowest risk of rupture, and UIAs in the posterior circulation and in the posterior communicating artery locations have a higher risk of rupture compared with the anterior circulation.
- The management of UIAs should be individualized. Numerous factors need to be considered, including the patient's age, general health, and family history, along with aneurysm factors, including size, location, and overall appearance.

previous subarachnoid hemorrhage, aneurysms measuring less than 7 mm in diameter had a low rupture rate, regardless of family history.

Small UIAs in the posterior circulation had a slightly higher risk of rupture than those located in the anterior circulation. The study also found that intervention and observation were similar in outcome and risk for small aneurysms.

Mayo researchers also examined whether the rupture risks continue at a constant level, increase with age, or decline over time. Results of the latest phase of ISUIA, completed in 2008, indicate that the annual risk of rupture remains the same

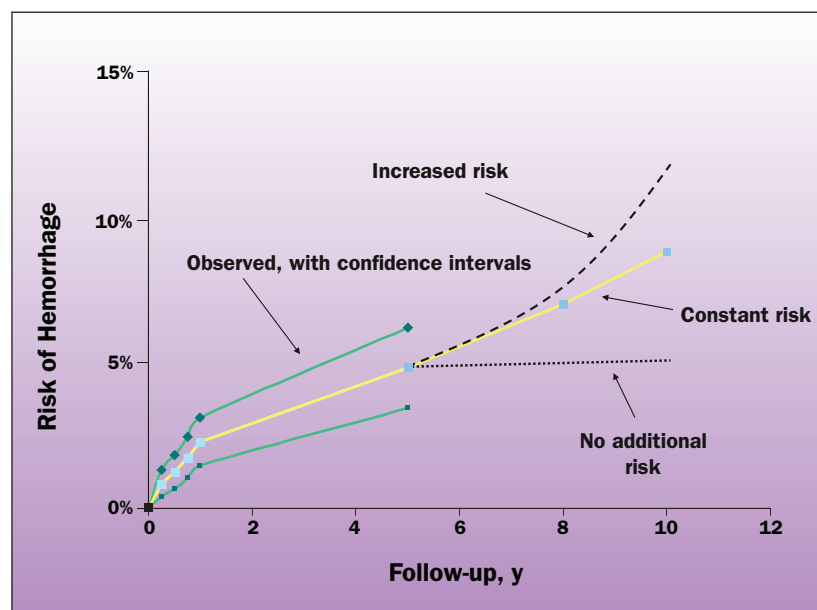


Figure 2. Long-term follow-up of unruptured intracranial aneurysms. Possible outcomes during long-term follow-up (about 10 years) of unruptured intracranial aneurysms: an unchanging, constant risk of hemorrhage, increasing risk of hemorrhage, and no additional risk of hemorrhage.

over an average of nearly 10 years of follow-up. For small UIAs, risk neither increased nor decreased significantly with increased age of the patient or time after discovery (Figure 2, page 3).

At Mayo Clinic's 3 sites, patients with UIAs are seen in a neurovascular clinic in which neurologists, radiologists, and neurosurgeons

together arrive at the best treatment option.

For More Information

While Mayo Clinic welcomes appointment requests for all neurologic and neurosurgical conditions, patients with cerebral aneurysms are offered expedited appointments. To refer a patient see page 8.

Nephron-Sparing Surgery to Manage Small Renal Masses, Minimize Risk of Chronic Renal Insufficiency

The Challenge

As cross-sectional imaging technology improves and as more patients undergo abdominal CT scans, more small renal masses, ie, those ≤ 7 cm, are incidentally found. In 1970, approximately 10% percent of renal masses were incidentally revealed; now, an estimated 70% are detected incidentally.

In the past, all renal masses were treated by radical nephrectomy. This radical procedure may predispose the patient to developing chronic renal insufficiency. For instance, many patients who develop renal masses are older than 60 years, diabetic, overweight, and



Figure 1. Mini-flank incision. To minimize postoperative pain and promote fast recovery, the mini-flank incision is made over the distal third of the 12th rib and never extends beyond the anterior axillary line.

Points to Remember

- Over the past 10 years, the treatment of small renal masses (≤ 7 cm) has been evolving.
- Nephron-sparing surgery is performed whenever possible to reduce the risk of chronic renal sufficiency associated with total nephrectomy. At Mayo Clinic, more than 80% of procedures to remove small renal masses are nephron sparing.
- Patients who undergo nephron-sparing surgery fare as well as radical nephrectomy patients in terms of oncologic outcomes and better in terms of long-term renal function and overall health.

hypertensive—the exact same risk criteria for chronic kidney disease (CKD). Recent studies have demonstrated that up to 25% of patients who present with renal masses may in fact have unrecognized CKD. Radical nephrectomy would serve to enhance progression of CKD and risk of cardiovascular comorbidity.

These serious risks are especially concerning when data show that 20% to 25% of all small renal masses are benign and as many as 66% are low grade or indolent tumors. Mayo Clinic was among the leading centers to develop a new approach to avoid overtreating select patients with small renal masses.

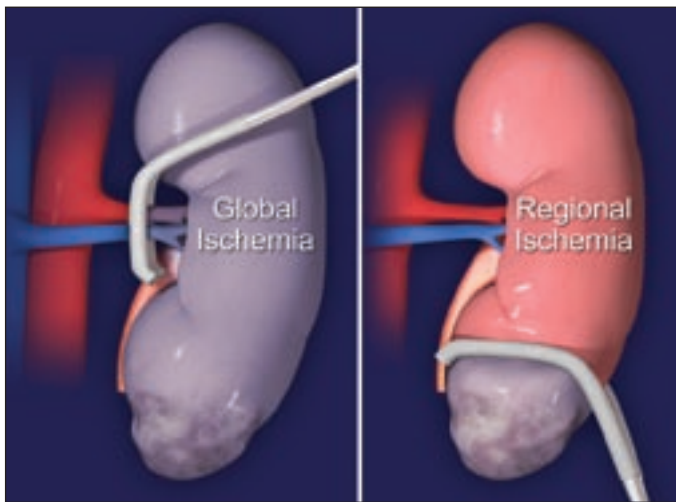


Figure 2. *Managing ischemia. Maintaining a bloodless surgical field to maximize visualization, precision, and hemostasis is fundamental to the success of nephron-sparing surgery. Global ischemia is considered for an internally growing kidney mass and centrally located tumors. The ideal mass for regional ischemia is one that grows outside the kidney surface, is polar in location and away from hilar structures.*



Figure 3. *Vascular control. A modified clamp allows for firm presentation of the kidney, improved vascular control without the need for extra hands in the wound, and meticulous dissection of the tumor.*

A New Approach

By 1990, Mayo researchers were testing partial nephrectomy—nephron-sparing surgery (NSS)—as an alternative means to treat small renal masses. The goal was to improve overall renal health and, in particular, to minimize the impact of kidney failure on other organ systems.

In NSS, the tumor is removed through a 9- to 12-cm mini-flank incision (Figure 1) under conditions of regional and global ischemia (Figure 2); regional ischemia spares unaffected nephron tissues vital for kidney function. By the late 1990s, positive outcomes supported this new approach and a shift in the treatment of small renal masses was under way.

Advantages of NSS

NSS offers the advantages of

- Comparable oncologic outcomes to the radical approach.
- Preserving kidney function and thereby helping prevent complications of chronic renal failure. Mayo Clinic researchers published data in 2000 showing that radical nephrectomy patients were 2 times more likely than NSS patients to develop chronic renal insufficiency. Other institutions have validated the efficacy of NSS in select patients.
- The mini-flank incision is half the size of a radical nephrectomy incision and affords patients faster and easier recovery and reduced hospital costs.

Elements of Success

The key to successful NSS is mastery of technique to operate in a bloodless field. This provides optimal visualization of transecting arteries and veins and reconstructed elements. In terms of surgical skill, it requires mastering multiple techniques for the surgical interruption of blood flow that include hypothermic global ischemia, warm ischemia, and regional ischemia.

Through varying the strategic placement of specialized instruments (Figure 3), the NSS surgeon maintains vascular control that permits accurate, swift performance of surgical maneuvers. Restoring blood flow to the kidney under conditions of warm ischemia within 12 minutes avoids damaging the organ. On the other hand, 50% of NSS at Mayo utilizes regional ischemia wherein non-tumor-bearing renal tissue is not subjected to the damaging effects of ischemia.

Suitable Candidates

In general, all patients diagnosed with a small renal mass no larger than 7 cm should be evaluated for NSS. Tumors that are well circumscribed are most suitable. The ideal mass for regional ischemia is one that grows outside the kidney surface, polar in location and away from hilar structures. Global ischemia is considered for an internally growing mass and centrally located tumors.

NSS Underutilized

At Mayo Clinic, more than 80% of procedures to remove small renal masses are now NSS. Underutilization of NSS may be attributable to lack of familiarity with the procedure and training to safely perform it. However, in the hands of experienced NSS practitioners, outcome data suggest NSS is the new standard of care for properly selected patients with small renal masses.

Adult Eosinophilic Esophagitis Well Managed With Topical Corticosteroid Treatments

Nature and Scope

The cause of eosinophilic esophagitis (EoE) in adults is largely unknown, but the leading hypothesis concerning its cause involves antigenic exposure to an airborne or food allergen that prompts a response in genetically predisposed individuals. The presentation of EoE ranges from solid-food dysphagia to food impaction, for which endoscopic dilation has been the primary treatment. However, endoscopy with dilation poses the potential complication of mucosal tears and perforation of the esophagus.

EoE is not rare. It has an annual incidence similar to that of Crohn disease, which is 12.9/100,000 people in Olmsted County, Minnesota. Multiple studies have shown increased prevalence of EoE over the past decade. Whether this rise is due to increased diagnosis or to an actual increase in the number of cases is not clear. What is clear is that because of this rise, more primary care professionals are likely to encounter patients with EoE and need to be aware of improved diagnostic and treatment approaches.

The Challenge

In the past, adults presenting with solid-food dysphagia were examined for mechanical or

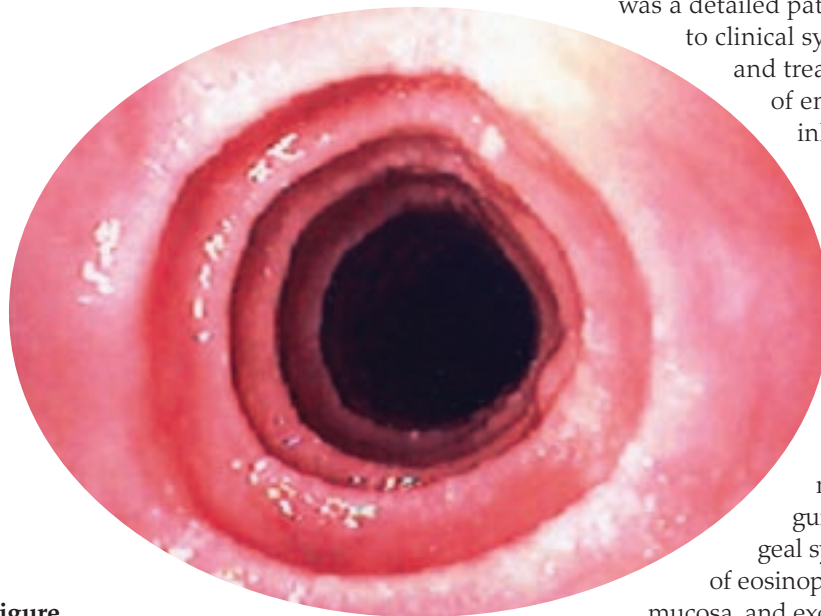


Figure. Abnormal esophageal mucosal findings include corrugated or ringed esophagus, white plaques, or linear furrows.

Points to Remember

- Eosinophilic esophagitis (EoE) is a common syndrome of unclear etiology presenting with solid-food dysphagia or impaction.
- New guidelines have established 3 criteria to support an EoE diagnosis.
- All patients with solid-food dysphagia should be evaluated by endoscopy and esophageal biopsy when there is no obvious anatomic reason for dysphagia.
- Mayo Clinic, a leader in diagnosis, treatment, and research in EoE, has developed several novel topical corticosteroid therapies that safely and effectively manage EoE symptoms.

anatomic reasons for obstruction, such as fibrotic strictures. If none was found, they either underwent empiric esophageal dilation or received no therapy at all. What was needed was a detailed pathologic description linked to clinical symptoms to inform diagnosis and treatment and limit the use of endoscopic dilation, with its inherent risks, to patients in whom medical therapy fails.

A New Approach

A consensus group of experts that included Mayo Clinic EoE specialists has provided new guidelines to support a diagnosis of EoE early, when it is most amenable to medical therapy (sidebar). The guidelines are based on esophageal symptoms (Figure), assessment of eosinophil density of the esophageal mucosa, and exclusion of gastroesophageal reflux disease (GERD). GERD requires different treatment from EoE.

Mayo Clinic specialists recommend performing esophageal biopsy on all patients

Criteria That Support a Diagnosis of Adult Eosinophilic Esophagitis

The eosinophilic esophagitis consensus group to which Mayo Clinic belongs recently established 3 criteria that support a diagnosis of EoE.

- **Presence of esophageal symptoms.** In adult patients, this is primarily solid food dysphagia. Children may have various symptoms, including chest pain, vomiting, dysphagia, and heartburn.
- **Presence of 15 or more eosinophils/high-power field** on esophageal biopsy. Eosinophils contribute to dysphagia by secreting compounds that make the esophageal lining sticky or by making the esophagus stiff and less effective in propelling food downward, thus disrupting the easy passage of food. Mayo Clinic research has shown abnormal esophageal mucosa, such as corrugated or ringed esophagus, white plaques, or linear furrows, in 80% of EoE cases. However, the esophagus has a normal endoscopic appearance in 20% of cases that meet EoE histologic and clinical criteria. Therefore, abnormal findings support the EoE diagnosis but are not required for it.
- **Exclusion of GERD.** GERD has been associated with eosinophilic infiltrate in the esophagus and can be easily confused with EoE. GERD must be excluded with an ambulatory pH study of a high-dose proton pump inhibitor treatment trial to meet the consensus definition of EoE.

with solid-food dysphagia. They also urge taking a patient history attentive to the presence of allergies because up to 70% of adult EoE patients have a history of seasonal allergies, rhinitis, asthma, or allergic dermatitis. The Mayo Clinic Eosinophilic Esophagitis Interest Group has one of the largest EoE clinical practices in the United States. With specialists at all 3 Mayo Clinic sites, Mayo is a leader in EoE management.

Treatment

Swallowed, aerosolized topical corticosteroid is the first-line medical therapy for adults with EoE. However, this is an inefficient way to deliver topical corticosteroid to the esophagus. Mayo Clinic specialists use several successful alternatives to the traditional oral

aerosol sprays. One of these new approaches is a topical mucosal adherent that is squirted into the back of throat with a syringe and a gel-based corticosteroid therapy that can be swallowed to coat the inside of the esophagus. Data show swallowed topical corticosteroids provide symptom relief for 80% to 90% of EoE patients. However, EoE symptoms recur in 91% of adult patients within 3 years of stopping therapy, with an average time to recurrent symptoms of 9 months. This high recurrence rate highlights the role of maintenance therapy in EoE.

To Refer a Patient

To refer patients for evaluation and treatment please see page 8.

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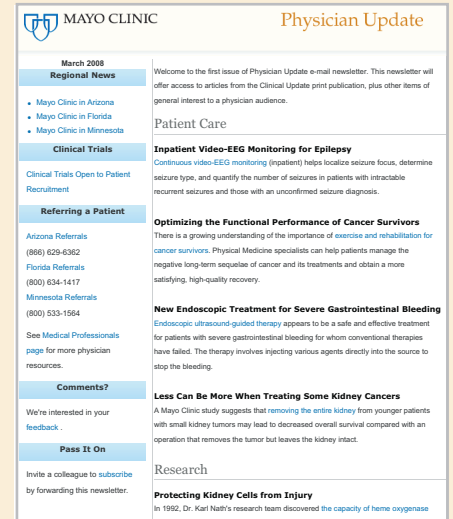
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