Pericardial and Epicardial Disease in *Circulation* and the *Circulation* Subspecialty Journals

The Editors

The following articles are being highlighted as part of *Circulation*’s Topic Review series. This series will summarize the most important manuscripts, as selected by the editors, published in *Circulation* and the *Circulation* subspecialty journals. The studies included in this article represent the articles related to pericardial and epicardial disease that were published in *Circulation* and the *Circulation* subspecialty journals in 2010 and 2011. (*Circulation*. 2012;125:e577-e582.)

Cardiac Magnetic Resonance Imaging Pericardial Late Gadolinium Enhancement and Elevated Inflammatory Markers Can Predict the Reversibility of Constrictive Pericarditis After Anti-Inflammatory Medical Therapy: A Pilot Study

**Summary:** Constrictive pericarditis (CP) is a disabling disease and usually requires pericardiectomy to relieve heart failure symptoms. Reversible cases of CP after anti-inflammatory therapy have been described, but there is no known method to predict the reversibility. We report our pilot study to assess whether cardiac MRI (CMR) pericardial late gadolinium enhancement (LGE) can predict the reversibility of CP after a course of anti-inflammatory therapy. Twenty-nine patients received anti-inflammatory medications after CMR. Fourteen patients had resolution of CP, whereas 15 had persistent constrictive physiology. Baseline LGE pericardial thickness was greater in the reversible CP group than in the persistent CP group. Qualitatively rated severity of pericardial LGE was moderate or severe in 93% of the reversible CP group versus 33% of the persistent CP group. CMR LGE pericardial thickness ≥3 mm had 86% sensitivity and 80% specificity to predict reversibility. The reversible CP group also had a higher baseline C-reactive protein and erythrocyte sedimentation rate level than the persistent CP group. Anti-inflammatory therapy was associated with a reduction in pericardial LGE, C-reactive protein, and erythrocyte sedimentation rate in the reversible CP group but not in the persistent CP group. Our findings in this pilot observation suggest that reversible CP is associated with pericardial and systemic inflammation. Furthermore, anti-inflammatory therapy is associated with a reduction of pericardial and systemic inflammation, as well as pericardial thickness on CMR LGE imaging, with resolution of constrictive physiology and symptoms. Anti-inflammatory therapy should be considered in CP patients with these features before pericardiectomy. Our findings need to be validated by further studies in a larger number of patients.

**Conclusions:** Reversible CP was associated with pericardial and systemic inflammation. Anti-inflammatory therapy was associated with a reduction in pericardial and systemic inflammation and LGE pericardial thickness, with resolution of CP physiology and symptoms. Further studies in a larger number of patients are needed.

Prevalence, Distribution, and Risk Factor Correlates of High Pericardial and Intrathoracic Fat Depots in the Framingham Heart Study

**Summary:** Visceral adipose tissue is an important marker of cardiometabolic risk. Although our understanding of visceral adipose tissue has relied on the abdominal adipose tissue compartment, new evidence suggests that visceral adipose tissue in the thorax may also have important cardiovascular effects and may represent a novel cardiovascular risk factor. In the present study, one third of individuals in a community-based sample had high levels of pericardial fat or intrathoracic fat (defined as having a fat volume higher than the 90th percentile of a healthy reference sample). Individuals with high levels of intrathoracic fat compared with those with high pericardial fat were found to have a more adverse cardiometabolic risk factor profile, characterized by a higher body mass index, a higher abdominal visceral fat, and a higher prevalence of metabolic syndrome. Given the expanding indications for thoracic imaging, thoracic adipose tissue quantification will become increasingly available. Our results suggest that intrathoracic fat volume may be a potential marker of metabolic risk and a surrogate for visceral fat on thoracic imaging.

**Conclusions:** Although prevalence of pericardial fat and intrathoracic fat were comparable at 30%, intrathoracic fat correlated more closely with metabolic risk and visceral fat. Intrathoracic fat may be a potential marker of metabolic risk and visceral fat on thoracic imaging.

Percutaneous Transatrial Access to the Pericardial Space for Epicardial Mapping and Ablation

**Summary:** Catheter ablation of ventricular tachycardia usually is a troublesome procedure because of the complexity of circuit’s organization, frequently encompassing subendocardial, intramyocardial, and subepicardial myocardial fibers. For this purpose, electrophysiologists have implemented many strategies for ventricular tachycardia mapping and ablation. One of them is to access the pericardial space through the percutaneous subxiphoid approach to map and ablate epicardial ventricular tachycardias. However, achieving the normal pericardial space is still a challenge for many electrophysiologists because of the potential risk of hemopericardium. In this study, we assessed the hypothesis that epicardial mapping and ablation can be performed through a vascular approach by using the femoral access to perforate the right atrium. Epicardial access was obtained in 20 pigs. Simulation of epicardial mapping and radiofrequency ablations were performed with regular electrophysiological tools without significant pericardial bleeding, even after their withdrawal, when the right atrium appendage was perforated. However, pericardial bleeding with hemodynamic collapse occurred when the puncture was performed outside the right atrial appendage (right ventricle in 1 animal and the tricuspid annulus in another). An occlusion device to seal the puncture in 3 animals (2 at right atrial appendage and 1 at the right ventricle) avoided significant pericardial bleeding. These preliminary observations suggest that...
Pericardial Fat Is Associated With Prevalent Atrial Fibrillation: The Framingham Heart Study

Summary: Obesity is a major risk factor for cardiovascular disease. However, the mechanisms for this association are not well understood. Pericardial fat represents a potentially novel risk factor for obesity-related cardiovascular disease and could partially explain the association between obesity and atrial fibrillation. The present study evaluated the association between pericardial fat volume and computed tomography and prevalent atrial fibrillation in 3217 Framingham Offspring participants who underwent cardiac computed tomography. Each increment in the standard deviation of pericardial fat volume was associated with a 28% increase in the prevalence of atrial fibrillation (odds ratio, 1.28; 95% confidence interval, 1.03–1.58). This association remained significant despite adjustment for known risk factors for atrial fibrillation, including body mass index. A similar association was not found for intrathoracic fat, a thoracic fat deposit that is not contiguous to cardiac structures. Our results are consistent with the hypothesis that adipose tissue in contact with cardiac structures may have deleterious effects. However, our findings must be confirmed in other cohorts.

Conclusions: Pericardial fat was associated with prevalent atrial fibrillation (AF) even after adjustment for AF risk factors, including body mass index. If this association is replicated, further investigations into the mechanisms linking pericardial fat to AF are merited.

Hospital Outcome of Moderate to Severe Pericardial Effusion Complicating ST-Elevation Acute Myocardial Infarction

Summary: Hospital prognosis of moderate to severe pericardial effusion (MPE; ≥10 mm) in ST-elevation myocardial infarction is largely unknown, and its management poses a therapeutic dilemma because not all patients benefit from emergency surgery aimed at treating an underlying free-wall rupture. Data from 446 ST-elevation myocardial infarction patients, 228 with MPE—88 with cardiac tamponade (CT) and electromechanical dissociation (EMD), 44 with CT and hypotension, and 96 without initial CT—and 218 with small PE (5–9 mm), were compared. CT patients showed larger PE (P<0.001) than those without initial CT; 85% of those with CT+EMD and 86% with CT plus hypotension were treated with pericardiocentesis, and 10% and 21% were treated with a surgical repair, respectively. Among MPE patients, 30-day mortality was 43% and was higher in those with CT+EMD (operated, 89%; nonoperated, 85%) than in those with CT plus hypotension (22% and 11%, respectively; P<0.001) and those without initial CT (17%; P<0.001). It was also higher than in patients with small PE (10%; P<0.001). Death was attributable to cardiac rupture in 83% of patients with CT+EMD, 7% with CT plus hypotension, and 8% with MPE without initial CT, and it occurred late (≥7 days) in 14%, 67%, and 100%, respectively. Thus, MPE carries an increased mortality, which is highest in patients with CT+EMD. In those with CT plus hypotension, however, mortality is considerably low after pericardiocentesis, and subsequent management may be individualized because a conservative approach is often successful. Importantly, MPE patients without initial CT are not free from late rupture and deserve further investigation.

Conclusions: MPE carries an increased mortality that is highest in patients with CTEMD. In those with CT without EMD, however, mortality is considerably low after pericardiocentesis, and subsequent management may be individualized because a conservative approach is often successful. Importantly, MPE patients without initial CT are not free from late rupture and deserve further investigation.

Risk of Constrictive Pericarditis After Acute Pericarditis

Summary: Constrictive pericarditis (CP) is a rare but dreaded possible complication of acute pericarditis. This risk is evident after tuberculous pericarditis in particular, whereas it is not well established after idiopathic and viral acute pericarditis, the most common causes of acute pericarditis in developed countries. In a prospective cohort study of 500 consecutive cases of acute pericarditis, after a mean follow-up of 60 months, CP developed in 9 of 500 patients (1.8%); 2 of 416 patients with idiopathic/viral pericarditis (0.48%) versus 7 of 84 patients with a nonviral/nonidiopathic etiology (8.3%). The incidence rate of CP was 0.36 cases per 1000 person-years for idiopathic pericarditis, 2.2 cases per 1000 person-years for connective tissue disease/pericardial injury syndrome, 6.33 cases per 1000 person-years for neoplastic pericarditis, 31.65 cases per 1000 person-years for tuberculous pericarditis, and 52.74 cases per 1000 person-years for purulent pericarditis. After a long follow-up, the overall number of cases of CP was relatively small (<2%). Patients and clinicians should be aware that CP is a rare complication of viral or idiopathic acute pericarditis. In contrast, nonidiopathic etiologies (especially bacterial) are correlated with an increased risk of complications and CP. Warning signs of a possible evolution toward CP are (1) an incessant course of the disease, (2) a nonidiopathic etiology, (3) large pericardial effusions, and (4) failure of empirical anti-inflammatory therapy. In contrast, a recurrent course has a lower risk of constriction.

Conclusions: CP is a relatively rare complication of viral or idiopathic acute pericarditis (0.5%) but, in contrast, is relatively frequent for specific etiologies, especially bacterial.

Unusual Complications of Percutaneous Epicardial Access and Epicardial Mapping and Ablation of Cardiac Arrhythmias

Summary: Percutaneous epicardial access and epicardial catheter ablation are being increasingly performed for the treatment of a variety of cardiac arrhythmias. Major complication rates of 5% and 2% for acute and delayed complications related to epicardial ventricular tachycardia ablation have been reported. The most common complications associated with this procedure are postprocedure pericarditis and inadvertent right ventricular puncture leading to transient or no pericardial bleeding. However, this technique can rarely be associated with unusual complications that can be life-threatening. This report lists 7 such complications from 5 centers over 5 years; (1) a right ventricular pseudoaneurysm related to right ventricular puncture, (2) intra-abdominal bleeding from hepatic injury, (3) subcapsular hepatic hematoma resulting from hepatic puncture during percutaneous access, (4 and 5) 2 cases of pericardial bleeding resulting from coronary sinus branch lacerations that occurred in one patient during access and the other possibly during sheath manipulation, (6) a right ventricular-to-abdomen fistula related to multiple right ventricular punctures during percutaneous access, and (7) 1 case of coronary arterial spasm that occurred during maneuvering within the pericardial space. These complications occurred at the time of either percutaneous access and/or during catheter mapping and ablation. It is important to recognize the importance of any unusual or persistent symptoms during/after epicardial ablation. If present, they should alert the clinician to the possible presence of a complication and consequently lead to a thorough work-up. Three of these complications, right ventricular pseudoaneurysm, subcapsular hepatic hematoma, and coronary artery spasm, did not require surgical intervention.
Conclusions: Though generally safe, percutaneous epicardial access and mapping/ablation can result in uncommon complications. Awareness of these rare complications may facilitate early detection and successful management.

Safety of Percutaneous Left Atrial Appendage Closure: Results From the Watchman Left Atrial Appendage System for Embolic Protection in Patients With AF (PROTECT AF) Clinical Trial and the Continued Access Registry

Summary: The Watchman Left Atrial Appendage System for Embolic Protection in Patients With AF (PROTECT AF) study randomized atrial fibrillation (AF) patients at risk for stroke to either usual therapy (warfarin) or percutaneous left atrial appendage closure with the Watchman filter device. It was the first randomized study to demonstrate both the critical role of the left atrial appendage in the pathogenesis of AF-related stroke and the ability of a filter device to recapitulate the clinical benefit of warfarin. However, the procedural safety of this new invasive procedure was a source of concern. Based on PROTECT AF and the Continued Access Protocol Registry, a registry that has followed the trial, we assessed the safety of left atrial appendage closure, including the temporal distribution of safety events, the rate of events with increased experience, and the functional significance of these events. This analysis revealed that the safety events in the Watchman group are largely clustered early in the periprocedural period and, after this point, the risk is minimal; that these safety events decrease in frequency with greater operator experience, particularly the rate of periprocedural stroke and pericardial effusion/tamponade; and that the rates of events resulting in significant disability or death were statistically significantly lower for the Watchman device compared with warfarin therapy in PROTECT AF. This article suggests that despite a higher numeric rate of complications with Watchman implantation compared with warfarin, a more nuanced understanding of these data indicates that the safety of left atrial appendage closure is more favorable when one considers the differential functional impact of these events and the significant decrease in the frequency of events with operator experience.

Conclusions: As with all interventional procedures, there is a significant improvement in the safety of Watchman left atrial appendage closure with increased operator experience.

Valve Configuration Determines Long-Term Results After Repair of the Bicuspid Aortic Valve

Summary: Valve replacement has been a reliable therapy for bicuspid aortic valve dysfunction for decades. To minimize valve-related complications, repair techniques have been developed in the last 2 decades. Repair of the bicuspid valve has been less challenging geometrically because only 1 coaptation line has to be corrected. Different publications, however, have given a puzzling view of the functional results of reconstruction with generally excellent early results and a worrisome rate of midterm failures. In the present study, we have found answers and new questions. The positive message is that reconstruction of bicuspid aortic valves is worthwhile for the low prevalence of valve-related complications. Repair works well with excellent durability in certain anatomic situations but should be avoided, at least with current reconstructive techniques, in others. A strong influence of anatomic characteristics on long-term durability of repair was found, with commissural orientation and degree of annular dilatation as the 2 most important predictors. Repair also had to normalize cusp configuration to achieve a good long-term result. On the other hand, the findings also emphasize the fact that bicuspid anatomy is not constant but rather includes a wide spectrum of anatomic variations. It is unclear whether annular dilatation is determined by anatomy or the duration of regurgitation. Thus, we need to define whether it can be neutralized by earlier repair. Surgeons will have to develop new strategies to ultimately allow durable reconstructive surgery in a larger proportion of patients with this anomaly.

Conclusions: Reconstruction of bicuspid aortic valve can be performed reproducibly with good early results. Recurrence and progression of regurgitation, however, may occur, depending primarily on anatomic features of the valve.

Adhesive Epicardial Corticosteroids Prevent Postoperative Atrial Fibrillation

Summary: Inflammation appears to play a central role in atrial fibrillation (AF) after cardiac surgery. Despite routine perioperative use of β-blockers and amiodarone, postoperative AF remains a common cause of morbidity and prolonged hospital stay. Corticosteroids have been shown to prevent postoperative AF but are not used because of the potential for systemic side effects. The current study evaluated the utility of a mixture of fibrin glue and triamcinolone sprayed onto the epicardium intraoperatively in an animal model of postoperative AF. During the first postoperative week, all of the control animals had spontaneous AF, compared with only 33% of treated animals, which also had much less histological evidence of atrial inflammation. There was no reduction in the tensile strength of a healing atriotomy and plasma steroid levels were low. Because fibrin glue is frequently applied to the epicardium for hemostasis during cardiac surgery, implementing this novel treatment for postoperative AF would be straightforward. The results of this study suggest that a clinical trial of this strategy should be undertaken.

Conclusions: A mixture of triamcinolone and fibrin glue sprayed onto the atria reduced postoperative atrial tachyarrhythmias and reduced inflammatory cell infiltration. There was no change in the tensile strength of a healing atriotomy and plasma steroid levels were low. Clinical trials of this approach are warranted.

Assessment of Catheter Tip Contact Force Resulting in Cardiac Perforation in Swine Atria Using Force Sensing Technology

Summary: Contact force is an important predictor of the efficacy of catheter-based radiofrequency ablation. It also represents a very important safety factor for electrophysiology procedures because excessive contact force can result in cardiac perforation. The optimal range for contact force needed to create adequate lesions has not been defined yet. The findings of this study demonstrated that cardiac perforation can occur with contact force values as low as 77 g during ablation. This may help define the range of optimal contact force, which is needed to improve the safety and efficacy of the ablation procedure.

Conclusions: Perforation of the atrial wall in a swine model can occur over a wide range of CF values. Perforation can occur with a CF as low as 77 g. Ablation reduces the perforating force by 23%.

Outcomes of Cardiac Perforation Complicating Catheter Ablation of Ventricular Arrhythmias

Summary: It is commonly perceived that the risk of ventricular perforation during catheter ablation is relatively small compared with atrial ablation because of the thicker ventricular walls. The present study provides the largest reported experience of cardiac perforation during catheter ablation for ventricular arrhythmias and describes its management and outcome. Of 1152 consecutive ventricular ablation procedures in 892 patients, 11 procedures (1.0%) were complicated by cardiac perforation. Cardiac tamponade was not encountered in the patients with prior cardiac surgery. In 6 patients, hemodynamic stability could not be restored despite pericardiocentesis and were emergently taken to the operating room for surgical repair. The exact location of perforation was confirmed at the time of cardiac surgery; 5 in the right ventricular (4 outflow tract, 1 free wall) and only 1 in the left ventricular. All patients survived to hospital discharge. Five of 6 patients who had steam pops during their last radiofrequency
energy application required surgical repair; perforations occurring in relation to steam pops were more likely to require surgical repair (P=0.07). This series emphasizes the infrequent but life-threatening possibility of both right and left ventricular perforations during ventricular tachycardia ablations and the importance of timely cardiac surgical interventions for effective management.

**Conclusions:** Ventricular perforation and tamponade occurs in 1% of ventricular ablation procedures and in this series, occurred only in patients without a history of prior cardiac surgery. More than half the patients required surgical repair. Perforation is often associated with steam pops and emergent surgical repair is often required when perforation occurs after a steam pop.12

**Long-Term Outcomes of Combined Epicardial and Endocardial Ablation of Monomorphic Ventricular Tachycardia Related to Hypertrophic Cardiomyopathy**

**Summary:** Monomorphic ventricular tachycardia (VT) is rare in patients with hypertrophic cardiomyopathy (HCM), and implantable cardioverter-defibrillators (ICDs) are the mainstay of therapy for prophylaxis against sudden cardiac death. For patients with recurrent ICD shocks despite aggressive antiarrhythmic medications and antitachycardia pacing, catheter ablation may be an option, although there are limited data regarding this. The present study details a series of case reports from multiple centers where combined epicardial-endocardial ablation was performed in a highly selected group of patients with HCM-related nonischemic VT. In these patients, the mechanism of monomorphic VT was mostly scar-related reentry. The location of scar was epicardial in 80% and endocardial in 60%. Using a combined epicardial-endocardial approach, radiofrequency ablation was effective in eliminating VT in 89% of patients acutely. Analysis of the freedom from recurrent ICD shocks showed that 78% of ventricular perforations occurring after a steam pop.12

**Conclusions:** In highly selected patients with HCM, combined epicardial and endocardial mapping and ablation is a feasible and reasonably efficacious option for patients with HCM-related nonischemic VT if refractory to aggressive trials of antiarrhythmic medications and antitachycardia pacing.13

**Comparative Evaluation of Left and Right Ventricular Endomyocardial Biopsy: Differences in Complication Rate and Diagnostic Performance**

**Summary:** Several recent clinical trials have demonstrated the therapeutic and prognostic benefits of EMB-based diagnoses such as myocarditis and other nonischemic cardiomyopathies. However, EMB is an invasive procedure with a nonnegligible risk of complications, and therefore its clinical use has been controversial. In the present study, the procedural safety and diagnostic performance of selective LV-EMB, selective RV-EMB, or biventricular EMB were comparatively investigated for the first time in patients with suspected myocarditis or nonischemic cardiomyopathies, using state-of-the-art techniques for sampling of biopsies as well as postprocedural histopathologic workup of specimens. In addition, the role of CMR as a noninvasive tool in diagnosing inflammatory and several noninflammatory cardiomyopathies as well as in guiding EMB was evaluated. Analyses of LV- and/or RV-EMBs in 755 patients revealed a major complication rate for LV-EMB of 0.64% and for RV-EMB of only 0.82%. Thus, both LV-EMB and RV-EMB turned out to be safe procedures. Moreover, on the basis of the results of this study, (1) biventricular biopsies have a higher diagnostic yield compared to selective biopsies and (2) LV-EMB gives a higher diagnostic yield compared to RV-EMB while having a lower risk for minor complications. Finally, there were no substantial differences in the number of positive diagnostic LV-EMBs, RV-EMBs, or biventricular EMBs when related to the site of CMR-based LGE. As suggested by a recently published consensus article for CMR-based diagnosis of myocarditis, the combined use of different CMR protocols for an improved CMR evaluation of myocarditis is recommended.

**Conclusions:** Both LV-EMB and RV-EMB are safe procedures if performed by experienced interventionalists. The diagnostic yield of EMB may be optimized when samples from both ventricles are available. Preferential biopsy in regions showing late gadolinium enhancement on cardiovascular magnetic resonance does not increase the number of positive diagnoses of myocarditis.14

**Periprocedural Stroke and Management of Major Bleeding Complications in Patients Undergoing Catheter Ablation of Atrial Fibrillation: The Impact of Periprocedural Therapeutic International Normalized Ratio**

**Summary:** Periprocedural thromboembolic and hemorrhagic events are complications of percutaneous radiofrequency catheter ablation of atrial fibrillation. The management of anticoagulation before and after radiofrequency catheter ablation could play an important role in the prevention of these complications. The incidence of thromboembolic events varies from 1% to 5%, depending on the ablation and the anticoagulation strategy used in the periprocedural period. At present, although discontinuation of warfarin 3 to 5 days before ablation with and without bridging with low-weight heparin is the most frequently implemented protocol, the optimal anticoagulation management (minimizing thromboembolism while not increasing hemorrhagic complications) is not well established. We first reported radiofrequency catheter ablation of atrial fibrillation without discontinuation of warfarin. This is the first large series of patients undergoing ablation of atrial fibrillation with different anticoagulation protocols and with different ablation catheters showing that the continuation of therapeutic warfarin during the procedure (radiofrequency catheter ablation) reduces the risk of periprocedural stroke/transient ischemic attack without increasing the risk of hemorrhagic events. Of interest, this anticoagulation protocol eliminates the need for a proprocedural transesophageal echocardiogram. A randomized controlled trial is necessary to confirm the results of our study.

**Conclusions:** The combination of an open irrigation ablation catheter and periprocedural therapeutic anticoagulation with warfarin may reduce the risk of periprocedural stroke without increasing the risk of pericardial effusion or other bleeding complications.15

**Feasibility of Circumferential Pulmonary Vein Isolation Using a Novel Endoscopic Ablation System**

**Summary:** Point-by-point ablation using radiofrequency current is the most commonly used approach for pulmonary vein isolation. Operators try to cope with the technical demands of this complex procedure by adding mapping and imaging tools as well as contact force–sensing technology. The novel endoscopic ablation system offers the benefits of an easily navigated balloon catheter enhanced by a direct view into the beating heart, thereby visualizing the ablation target. In addition, unlike other balloon technologies, it offers maximum flexibility for both ablation line design and ablation power titration. This might obviate our need for sophisticated additional technologies for catheter navigation and for surrogate parameters determining ablation power control such as contact force. Future developments might yield direct insights into lesion formation and allow for individual titration of ablation energy under vision. However, only the first steps have been taken, and future clinical trials will provide information on the true advantages of this promising technology.

**Conclusions:** Circumferential pulmonary vein isolation using the novel compliant endoscopic ablation system was feasible in the
Acute and Chronic Effects of Epicardial Radiofrequency Applications Delivered on Epicardial Coronary Arteries

Summary: We studied in a porcine model the acute and chronic histopathologic changes of epicardial vessels to evaluate the potential risk of delivering radiofrequency ablation in proximity to coronary arteries. The main finding of our study suggest that significant arterial damage (defined as tunica intima and media thickening) can occur several months after epicardial ablation even in the absence of acute coronary occlusion. These results have significant implications for epicardial catherer ablation that delivering radiofrequency energy close to an epicardial vessel will result in different levels of vascular injury, ranging from acute occlusion to late intimal hyperplasia. Thus, the decision to deliver radiofrequency closer than 5 mm to the vessels should be based on the clinical need, which should be balanced with the risk of vascular injury.

Conclusions: In this porcine model of in vivo epicardial radiofrequency ablation in proximity to coronary arteries leads to acute and chronic histopathologic changes characterized by tunica intima and media thickening, with replacement of smooth muscle cells with extracellular matrix, but no significant stenosis was observed up to 70 days after the ablation. The absence of acute coronary occlusion or injury does not preclude subsequent significant arterial damage, which frequently occurs when epicardial radiofrequency applications are delivered in close vicinity to the vessels.

Mitral and Tricuspid Annular Velocities Before and After Pericardiectomy in Patients With Constrictive Pericarditis

Summary: The diagnosis of constrictive pericarditis often is challenging even after multiple diagnostic tests. Tissue Doppler imaging of the mitral annulus has facilitated the identification of constriction, which potentially is curable by pericardiectomy. Preserved or augmented medial annulus early diastolic velocity in a patient with heart failure and normal ejection fraction points to the diagnosis of constriction. However, this finding is not that helpful in young patients who normally have preserved early diastolic mitral annulus velocity. The additional finding of lower mitral lateral annulus early diastolic velocity compared with the medial annulus increases confidence in the diagnosis of constriction. Although normal or increased mitral medial annulus velocity strongly suggests the diagnosis of constriction, it may be reduced if there is superimposed myocardial disease. Even in this situation, the mitral lateral annulus velocity usually is lower than that at the medial annulus. The fact that annular velocities return to lower values after pericardiectomy confirms that the characteristic annulus velocity pattern observed is a product of constrictive pericardium. We need to take advantage of this simple measurement when evaluating a patient with heart failure and normal left ventricular ejection fraction.

Conclusions: The mitral lateral/medial e’ ratio is reversed in three-fourths of patients with constrictive pericarditis (PC). All annular velocities are lower in secondary compared to primary CP before pericardiectomy. After pericardiectomy, there is reduction of all annular velocities and normalization of the mitral lateral/medial e’ ratio.

Prevalence of C-Reactive Protein Elevation and Time Course of Normalization in Acute Pericarditis: Implications for the Diagnosis, Therapy, and Prognosis of Pericarditis

Summary: Pericarditis is an inflammatory disease, and evidence of elevated markers of inflammation could support the diagnosis. Unfortunately, the appropriate length of therapy is unknown, and drugs are administered empirically. Nevertheless, markers of inflammation (i.e., C-reactive protein [CRP]) may be a useful guide for treatment because it can be assumed that anti-inflammatory therapy should be continued until the inflammation is extinguished. On this basis, persistent elevation of inflammatory markers, as evidence of disease activity, could be associated with a worse prognosis. No prospective study has evaluated the prevalence and clinical meaning of CRP for diagnosis, therapy, and prognosis in acute pericarditis. The main conclusions of the study are as follows: (1) high-sensitivity CRP (hs-CRP) is elevated at the initial presentation in ~3 of 4 cases of acute pericarditis, and thus a normal value of hs-CRP at presentation does not exclude the diagnosis but may confirm the clinical suspicion; (2) persistently elevated hs-CRP may identify patients at higher risk of recurrence; (3) for patients with elevated hs-CRP, the attack dose of anti-inflammatory therapy should be continued until hs-CRP normalization instead of an empirical therapy length, as is commonly done in clinical practice; and (4) in some patients, hs-CRP is normal at presentation but may increase within the first week, and thus appropriate serial testing for hs-CRP should be planned for patients with an initial negative result. Hs-CRP is elevated at the initial presentation in ~3 of 4 cases of acute pericarditis, identifies patients at higher risk of recurrence, and could be used to monitor disease activity and select appropriate therapy length.

Conclusions: Hs-CRP is elevated at the initial presentation in ~3 of 4 cases of acute pericarditis, identifies patients at higher risk of recurrence, and could be used to monitor disease activity and select appropriate therapy length.

Predicting Survival in Pulmonary Arterial Hypertension: Insights From the Registry to Evaluate Early and Long-Term Pulmonary Arterial Hypertension Disease Management (REVEAL)

Summary: The Registry to Evaluate Early and Long-Term Pulmonary Arterial Hypertension Disease Management (REVEAL) was designed to assess longitudinal clinical course and disease management in the largest cohort of patients with pulmonary arterial hypertension ever monitored. Pulmonary arterial hypertension remains a morbid disease unless well-timed clinical intervention is implemented. Therefore, factors that determine survival in pulmonary arterial hypertension can significantly drive and focus clinical management. We analyzed data from 2716 patients with pulmonary arterial hypertension to derive a multivariable, weighted risk formula that could be used by the practicing clinician at any time in the course of a patient’s disease progression to predict survival. Nineteen independent factors were identified as having an impact on patient survival. A multivariable risk formula comprising all 19 factors provided a more accurate assessment of clinical outcome than each independent variable. These results emphasize the importance of the full spectrum of clinical data commonly available to the practicing clinician for the assessment of patients with pulmonary arterial hypertension. We believe that the risk stratification provided by this predictive equation will facilitate counseling of patients about their disease and prognosis and will provide a benchmark for prospective evaluation of new therapies.

Conclusions: We identified key predictors of survival based on the patient’s most recent evaluation and formulated a contemporary prognostic equation. Use of this tool may allow the individualization and optimization of therapeutic strategies. Serial follow-up and reassessment are warranted.

Left Atrial Epicardial Adiposity and Atrial Fibrillation

Summary: Inflammation plays a prominent role in cardiovascular disease and has been the focus of intense cardiovascular research. Recently, epicardial fat has been shown to be associated with increased production of several markers of inflammation. Further-
more, it is postulated to exert a locally toxic effect on coronary arteries via perivascular inflammation, therefore contributing to coronary atherosclerosis. In our study, we investigated whether or not left atrial epicardial fat may be associated with atrial fibrillation, given its proximity to the pulmonary veins ostia, which have known implications in atrial fibrillation (AF) pathogenesis. Our study suggests that the thickness of the posterior epicardial fat pad between the left atrium (LA) and the esophagus (LA-ESO), which can easily be measured using cardiac computed tomography (CT), is associated with an increased AF burden independent of the known AF risk factors of age, body mass index, and LA size. These findings have potential implications for better understanding of AF pathogenesis. Inflammation and inflammatory states have not only been associated with AF duration and persistence, but also with future development of AF in patients without prior history of AF. Further studies are needed to determine whether the epicardial fat in the posterior LA causes inflammation and subsequent AF or is merely associated with inflammation and AF. Measurement of LA-ESO thickness during cardiac CT may prove to have a role similar to other routinely measured inflammatory markers in relation to AF.

Conclusions: Increased posterior LA fat thickness appears to be associated with AF burden independent of age, body mass index, or LA area. Further studies are necessary to examine cause and effect, and if inflammatory, paracrine mediators explain this association.

Fatal End of a Safety Algorithm for Pulmonary Vein Isolation With Use of High-Intensity Focused Ultrasound

Summary: Recently, a novel balloon-based ablation system that uses high-intensity focused ultrasound to achieve pulmonary vein isolation was shown to be feasible, but fatal esophageal injury was also observed. In this study, an esophageal temperature–guided safety algorithm was applied in a series of patients undergoing high-intensity focused ultrasound ablation. Unfortunately, this safety algorithm failed to prevent lethal atriösephageal fistula formation. Therefore, at the present time, high-intensity focused ultrasound does not meet the safety standards required for treatment of atrial fibrillation. This study shows that new and promising tools for the treatment of atrial fibrillation are not always safe, in this case even with careful implementation of a safety algorithm based on understanding of the cause of adverse effects. Furthermore, the mechanism of esophageal lesion formation remains poorly understood. For both the practicing clinician and the clinical investigator, these findings will heighten awareness of potential hazards of new and promising medical devices.

Conclusions: The safety algorithm failed to prevent lethal complications. Currently high-intensity focused ultrasound does not meet the safety standards required for treatment of atrial fibrillation.

References


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