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Clinical Cardiology [ALERT]

Critical analysis of the latest clinical research in cardiovascular medicine

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ABSTRACT & COMMENTARY

ORBITA: Learning the Right Lessons From a Sham-controlled Trial of Angioplasty

By Jeffrey Zimmet, MD, PhD

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Dr. Zimmet reports no financial relationships relevant to this field of study.

SYNOPSIS: In this sham-controlled trial of 200 patients with single-vessel coronary artery disease and stable angina, percutaneous coronary intervention did not increase exercise time significantly compared to a placebo procedure.

SOURCE: Al-Lamee R, Thompson D, Dehbi HM, et al. Percutaneous coronary intervention in stable angina (ORBITA): A double-blind, randomised controlled trial. *Lancet* 2017 Nov 1. pii: S0140-6736(17)32714-9. doi: 10.1016/S0140-6736(17)32714-9. [Epub ahead of print].

While percutaneous coronary intervention (PCI) produces beneficial effects on hard outcomes in acute coronary syndromes, the situation is quite different in chronic stable angina (CSA), where the primary goal of intervention is recognized to be angina reduction. Trials of PCI in CSA have not shown a benefit in terms of mortality or myocardial infarction compared with medical therapy. Also, no one has performed a placebo-controlled trial of PCI in CSA.

This, in a nutshell, is what the authors of the ORBITA trial set out to accomplish. Patients were selected carefully. Each patient exhibited angiographically significant disease in a single vessel with "angina or equivalent symptoms." Patients with disease in more than one vessel were excluded, as were patients with left main disease, prior coronary artery bypass grafting, or presentation consistent with acute coronary syndrome. Patients with severe left ventricular dysfunction also were excluded, and nearly all patients enrolled demonstrated normal ejection fraction.

All patients began with a purely diagnostic coronary angiogram that defined their eligibility. Symptoms were assessed by standard research instruments prior to an intensive six-week medical optimization phase during which medical therapy, including dual

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antiplatelet therapy, began. Antianginal medications were titrated aggressively in all patients through phone consultations with a cardiologist up to three times per week. Cardiopulmonary exercise testing (CPET) and dobutamine stress echocardiogram (DSE) were performed just prior to the index procedure. For the research procedure itself, all patients underwent an assessment of fractional flow reserve (FFR) and instantaneous wave-free ratio (iFR) before randomization to PCI or placebo, although, interestingly, the operators were blinded to the results of this physiologic testing. Patients were sedated and wore headphones to assure blinding. The primary endpoint was the difference in exercise time increment between groups, assessed six weeks after the procedure. Secondary endpoints included standardized assessments of angina and quality of life, change in peak oxygen uptake, and change in DSE wall motion index.

Two hundred patients underwent randomization: 105 to PCI, and 95 to the sham procedure. Most patients were assessed as exhibiting class II or III angina, and effort tolerance pre-randomization was quite good overall, with patients averaging > 8 minutes on the treadmill. At the index procedure, coronary lesions were assessed to be physiologically severe on average, with a mean FFR value of 0.69. PCI led to improvement to a mean FFR of 0.90. Importantly, approximately 30% of lesions overall were not physiologically significant by FFR and iFR assessment.

At the six-week post-procedure assessment, exercise times had increased in both groups. Although the increase was greater in the PCI group, the between-group difference was not statistically significant. The DSE peak stress wall motion score index improved more with PCI than with placebo, demonstrating an objective improvement in ischemia, but no significant differences in symptoms were seen between groups during follow up.

The authors concluded that in patients with medically treated CSA, PCI did not improve exercise time or angina symptoms significantly compared to a sham procedure despite improving hemodynamic and imaging indices of ischemia.

■ COMMENTARY

Predictably, reactions to the ORBITA results, both among cardiologists and in the lay press, have been relatively sensational. Some commentators have used the results to make blanket statements about the utility of PCI in CSA altogether, while others, including the study authors, caution against such overreach. The authors of an accompanying editorial took a particularly black and white view, concluding that there are "no benefits for PCI compared with medical therapy for stable angina, even when angina is refractory to medical therapy." What can cardiologists rightfully believe?

At the base of it, ORBITA was a well-executed and difficult-to-accomplish trial, completing the first-ever study of CSA that included a sham control. The study procedures were meticulous, the blinding was well thought out and effective, and the assessment procedures were comprehensive.

Although the study benefits from numerous obvious strengths, it also featured some shortcomings that should be highlighted for better understanding of its true message and implications. The study size was relatively small, with only 100 patients in each group, and the patients demonstrated good effort capacity coming into the trial, making it difficult to show an incremental benefit of PCI. In fact, formal CPET showed that peak oxygen uptake at baseline was essentially normal for patients in this age range.

All patients underwent invasive assessment of the index lesions by FFR and iFR, but these results were not used in assessment of lesion significance and were not made available to the operators. As it turned out, although all lesions were judged to be significant angiographically, nearly one-third of patients exhibited FFR values that do not meet current thresholds for interventional treatment and would not be expected to benefit significantly from PCI. At the same time, the change in mean FFR for the entire population was highly important. This suggests a

high degree of heterogeneity in lesion severity among patients in this modest-sized trial. However, there is little doubt that these functional assessments are underused in clinical practice.

In performing FFR assessments, four patients in the placebo group underwent unplanned PCI because of lesion disruption by the FFR wire. It is important to recognize that this complication is quite rare with intermediate lesions and is far more likely to occur with truly severe lesions. The end result in this case is that four placebo group patients with the most critical disease were treated by PCI, with obvious potential to skew the data in this small trial.

But the most important lessons are those we should know already, primarily that medical therapy in CSA patients can be effective when performed well, and that both patients and providers should understand that medical therapy is a viable option for clinical scenarios that fit the trial paradigm. The clinical situation studied in the trial is common in practice, and too often patients come to the cath lab on inadequate medical therapy with a plan to receive a combined diagnostic and therapeutic procedure. Such ad hoc PCI, while extremely common and often in the patient's best interests, can also short-change the discussion of treatment options in favor of interventional therapy. The focus of the trial was more narrow than the editorialists suggested, a point worth emphasizing. The authors of ORBITA studied CSA patients with single-vessel coronary artery disease, normal left ventricular function, and very little functional limitation as defined by formal exercise testing. To extrapolate these results to all CSA patients would be both incorrect and an unfortunate disservice to patients. ■

ABSTRACT & COMMENTARY

Risk of Major Bleeding With Concurrent Medications in Atrial Fibrillation Patients Taking New Oral Anticoagulants

By Michael H. Crawford, MD, Editor

SYNOPSIS: A large nationwide comprehensive clinical database showed that concomitant use of the new oral anticoagulants with amiodarone, fluconazole, rifampin, and phenytoin increases the risk of major bleeding.

SOURCE: Chang SH, Chou IJ, Yeh YH, et al. Association between use of non-vitamin K oral anticoagulants with and without concurrent medications and risk of major bleeding in nonvalvular atrial fibrillation. *JAMA* 2017;318:1250-1259.

Little is known about the risk of bleeding with the new oral anticoagulants (NOACs) in atrial fibrillation (AF) patients on multiple other drugs for various comorbidities. Investigators evaluated the bleeding risk in AF patients on NOACs associated with the concurrent use of 12 commonly prescribed medications that share the metabolism pathways of the NOACs, such as CYP3A4 inhibitors and P-glycoprotein competitors. This was a retrospective analysis of the Taiwan National Health Insurance Administration database, which includes robust clinical information. More than 91,000 patients were identified who demonstrated nonvalvular AF and had received at least one NOAC prescription between 2012 and 2016. The primary outcome was major bleeding, excluding trauma bleeding. The analysis model used a propensity score to adjust for covariates. The mean age of the patients was 75 years. Fifty-six percent were men. Their mean baseline CHA_2DS_2-VASc score was 4, and their HAS-BLED mean score was 3.3. Comorbidities such as heart failure, diabetes, and cerebrovascular disease were common. The NOACs used during the four years were rivaroxaban in 59%, dabigatran in 50%, and apixaban in 14%. There were 4,770 major bleeds per 447,037 person-quarter of years of follow-up. Significant increases in adjusted bleeding rate differences compared to NOAC use alone were seen with amiodarone (14 per 1,000 person-years), fluconazole (138), rifampin (37), and phenytoin (52). Atorvastatin, digoxin, erythromycin and clarithromycin were associated with reduced incidence rates. Other combinations, such as with diltiazem, verapamil, cyclosporine, and other azoles, neither increased nor decreased bleeding rates. There were no differences in bleeding rates on the various combinations between the three NOACs. The authors concluded that in patients taking NOACs, concomitant use of amiodarone, fluconazole, rifampin, and phenytoin is associated with a significant risk of major bleeding compared to NOAC use alone.

■ COMMENTARY

Many hoped that the NOACs would free clinicians from the concern about drug interactions with warfarin. The authors of this study noted that drug interactions are reduced, but not eliminated, by

NOACs. Clearly, there are drugs clinicians should avoid prescribing for patients on NOACs because of a marked increase in the risk of bleeding. These are in the order of risk: fluconazole, phenytoin, rifampin, and amiodarone. The data on amiodarone are different from data presented in the ARISTOTLE study (apixaban vs. warfarin) in which no increase in bleeding risk was found. However, the authors of ARISTOTLE studied far fewer patients and this was the lowest increased risk found in this study. On the other hand, several drugs that are known to increase plasma levels of NOACs in pharmacodynamic studies and were predicted to increase bleeding risk did not in this analysis: diltiazem, verapamil, cyclosporine, and other azoles. Paradoxically, some drugs actually appeared to lower the bleeding risk: atorvastatin, digoxin, and mycin antibiotics. This may be because other positive effects of these drugs lowered bleeding risk or chance, but their use does not seem to be a concern. Of the four drugs that accounted for 20% of the concomitant drug use (digoxin, diltiazem, amiodarone, and atorvastatin), only amiodarone was of concern. The strength of this study is that it was based on a very large and comprehensive nationwide database in a country with a one payer system. Potential limitations are that this country (Taiwan) represents an Asian population and that the data may not reflect other ethnicities. Also, drug dosages were not considered in the analysis because of the overwhelming complexity this would pose. Additionally, liver and renal function data were not analyzed for the same reason. Finally, there are no data on edoxaban, which was not approved for use in Taiwan during the study period. However, there was no difference between the other three NOACs in the observed interaction patterns, so there is no reason to suspect edoxaban would act differently.

The use of amiodarone, fluconazole, rifampin, and phenytoin with NOACs increased the risk of major bleeding, whereas other commonly used drugs in AF patients did not. ■

ABSTRACT & COMMENTARY

Value of Liver Function Tests in Cardiogenic Shock

By Michael H. Crawford, MD, Editor

SYNOPSIS: A prospective, multicentered, observational study of patients admitted with cardiogenic shock showed that a > 20% rise in alanine aminotransferase in the first 24 hours is associated highly and independently with 90-day mortality.

SOURCE: Jäntti T, Tarvasmäki T, Harjola VP, et al. Frequency and prognostic significance of abnormal liver function tests in patients with cardiogenic shock. *Am J Cardiol* 2017;120:1090-1097.

Abnormal liver function tests (LFTs) are known to be of prognostic valve in acute and chronic heart failure. Cardiogenic shock (CGS) is the most profound form of acute heart failure, yet there are little data on the value of LFTs in CGS. Investigators from the European CardShock study, a multinational, prospective, observational study of 178 patients admitted for CGS between 2010 and 2012 from nine tertiary hospitals in eight European countries, assessed the prevalence of LFT abnormalities, their serial changes, and effects on outcome. CGS inclusion criteria were systolic blood pressure < 90 mmHg and signs of hypoperfusion after an adequate fluid challenge. Exclusion criteria were significant arrhythmias or shock after surgery. The evaluation and treatment were at the discretion of the local physicians. Blood samples were obtained serially at 12-hour intervals. An increase in LFT values was defined as a > 20% rise from baseline in the first 24 hours. If the highest LFT value was in the normal range, it was considered not increased. The primary endpoint was 90-day all-cause mortality. The mean age of the patients was 66 years. Seventy-four percent were men. Most exhibited an acute coronary syndrome (80%), and the 90-day mortality was 42%.

Among the LFTs, alanine aminotransferase (ALT) was abnormal most frequently, was elevated at baseline in 58% of patients, and was abnormal at all time points more commonly in non-survivors. An increase in ALT > 20% in the first 24 hours was observed in 24% of patients and was associated with an increased mortality compared to those with stable or falling levels (70% vs. 28%; $P < 0.001$). Multivariate regression analysis showed that an ALT increase > 20% was associated independently with 90-day mortality (hazard ratio, 3.16; 95% confidence interval, 1.72-5.82; $P < 0.001$). An ALT > 20% increase was associated with oliguria, left ventricular ejection fraction, and peak troponin and lactate levels, but not NT-proBNP. The authors concluded that an increase in ALT was observed in about one-quarter of patients

in the first 24 hours after admission for CGS and was associated independently with 90-day mortality.

■ COMMENTARY

The most recent guidelines for the management of CGS recommend daily LFTs and lactate every one to four hours.[1] This study suggests that among the LFTs, ALT alone should be measured at least at admission, 12 hours, and 24 hours later. How ALT would compare to lactate levels was not studied in this analysis, but it was noteworthy that in a multivariate model that included lactate, a > 20% rise in ALT was a strong, independent predictor of 90-day mortality. A > 20% rise is rather modest but is powerfully associated with other signs of persistent hypoperfusion. Other LFTs also may be abnormal but are not predictive of early mortality and need not be followed frequently. Although elevated baseline ALT levels were frequent (58%) and more common in non-survivors, they did not predict early mortality. This is probably because baseline ALT may be elevated because of other causes such as alcohol use or chronic right heart failure. There were some limitations to this study. It was rather small, and although all 178 patients underwent baseline LFTs, only 154 had samples at 12 and 24 hours. Some patients died in < 24 hours. Hemodynamic measurements of the pulmonary circulation were performed in a minority of patients since this is not a uniform recommendation in CGS patients but rather a more selected one. Since this was an observational study, it is impossible to consider all potential confounders. The main strength of the study was that it was the first to systematically evaluate early serial LFTs in CGS patients. The authors recommended that ALT should be performed serially in the first 24 hours a patient receives treatment for CGS as a rising level suggests that tissue perfusion is not adequate for survival. ■

REFERENCE

1. van Diepen S, Katz JN, Albert NM, et al. Contemporary management of cardiogenic shock: A scientific statement from the American Heart Association. *Circulation* 2017;136:e232-e268.

ABSTRACT & COMMENTARY

Cardiac Magnetic Resonance Identifies High-risk Patients With Acute Myocarditis and Preserved Ejection Fraction

By Van Selby, MD

Assistant Professor of Medicine, University of California, San Francisco Cardiology Division, Advanced Heart Failure Section

Dr. Selby reports no financial relationships relevant to this field of study.

SYNOPSIS: In patients with acute myocarditis and preserved left ventricular ejection fraction who underwent cardiac magnetic resonance, the presence of late gadolinium enhancement involving the midwall layer of the anteroseptum was associated with a worse prognosis.

SOURCE: Aquaro GD, Perfetti M, Camastra G, et al. Cardiac MR with late gadolinium enhancement in acute myocarditis with preserved systolic function: ITAMY study. *J Am Coll Cardiol* 2017;70:1977-1987.

Cardiac magnetic resonance (CMR) is used frequently in the evaluation of acute myocarditis (AM). In addition to its diagnostic utility, CMR also can help determine prognosis in AM. In particular, the presence of late gadolinium enhancement (LGE), a sign of myocardial scar, has been associated with worse patient outcomes. However, it is unknown whether all patterns of LGE observed in AM carry the same prognostic implications. Aquaro et al evaluated CMR results from 386 patients with confirmed AM and ejection fraction (EF) > 50% who were enrolled in the ITAlian multicenter study on Acute MYocarditis (ITAMY). Patients with heart failure, arrhythmias, or hemodynamic instability at the time of presentation were excluded. Patients were categorized based on the pattern of LGE observed on the baseline CMR. The primary endpoint was a composite of cardiac death, hospitalization for heart failure, resuscitated cardiac arrest, or appropriate implantable cardioverter-defibrillator firing. The median age was 35 years, and 95% of patients presented with chest pain. Four distinct LGE patterns were identified. One hundred fifty-four patients (41%) exhibited diffuse LGE throughout the subepicardial layer of the inferior and lateral segment. In 135 patients (36%), LGE was identified in the midwall of the anteroseptum (referred to as the AS group). Fifty-nine patients (15%) demonstrated LGE in other distributions, and 26 patients exhibited no LGE. Patients in the AS group showed larger

ventricular volumes, higher peak troponin levels, and lower levels of inflammatory markers at presentation.

Over a median follow-up of 1,572 days, patients in the AS group received a worse prognosis compared to those in other groups ($P < 0.0001$). In a multivariable analysis, the presence of AS LGE was the strongest independent CMR predictor of the primary endpoint (odds ratio, 2.73; $P = 0.01$). The AS pattern also was associated with subsequent worsening of EF on follow-up studies. There were no significant differences in outcomes among the other three patient groups. The authors concluded that in patients with AM and preserved EF, LGE in the midwall layer of the anteroseptum is associated with a worse prognosis compared to other LGE patterns.

■ COMMENTARY

In acute myocarditis, both the clinical presentation and disease course are highly variable. Most patients in the Aquaro et al study presented with infarct-like AM, characterized by chest pain and ECG abnormalities. In cases of infarct-like AM with preserved EF, CMR is particularly sensitive for the detection of myocarditis and has become the diagnostic imaging modality of choice in these patients. In cases of myocarditis presenting with heart failure or arrhythmias, CMR is less sensitive and endomyocardial biopsy is used often.

Left ventricular EF is one of the strongest predictors of survival in AM, but some patients with normal EF still will proceed to adverse outcomes, including arrhythmia, heart failure, or death. LGE also is associated with worse outcomes, even in patients with preserved EF. Aquaro et al built on previous knowledge regarding predictors of adverse outcomes in AM. By looking at the specific pattern of LGE, clinicians can identify those patients with a poor prognosis despite normal EF at presentation. Approximately one-third of all patients presenting with AM and preserved EF demonstrated this AS pattern of LGE that places them at increased risk for adverse outcomes. Given the frequency with which CMR is obtained in these patients, it is important for clinicians to recognize this as a specifically high-risk pattern rather than just looking for the presence or absence of LGE. In fact, with the AS group excluded, survival was similar among those patients with and without LGE.

The major limitation of this study is the small sample size, with only 29 total events between the four groups. The patient population also was somewhat restricted, and the findings can be applied only to AM patients with normal EF and no evidence of heart failure, arrhythmia, or hemodynamic instability. However, the patients studied are the ones most likely to undergo CMR in clinical practice. The study is also limited by the lack of T1 and T2 mapping, which are used increasingly in the evaluation of AM patients.

It is not clear why one particular LGE pattern would be associated with worse outcomes. Compared to patients in other groups, those with AS generally exhibited more ventricular enlargement and higher troponin levels at presentation, despite lower levels of inflammatory markers. This suggests a difference in the underlying pathophysiology. A prior study of LGE patterns in AM found that AS generally was associated with human herpesvirus 6 infection, whereas the inferolateral pattern was seen in patients with parvovirus infections. While it is possible that different viral pathogens can explain the observed differences in outcome, Aquaro et al did not include viral testing and, therefore, cannot answer this question with any certainty.

Cardiac MR already is gaining acceptance as the diagnostic test of choice in patients with AM and no heart failure or arrhythmia. The study by Aquaro et al further solidifies the utility of CMR and provides a new high-risk feature that clinicians should look for when interpreting these studies. ■

ABSTRACT & COMMENTARY

Optimizing Outcomes for Invasive Treatment of Long-standing, Persistent Atrial Fibrillation

By Joshua D. Moss, MD

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Dr. Moss reports no financial relationships relevant to this field of study.

SYNOPSIS: In patients with long-standing, persistent atrial fibrillation, outcomes with an electrophysiologically guided thoracoscopic surgical ablation procedure were superior to a standard catheter approach.

SOURCE: Haldar SK, Jones DG, Bahrami T, et al. Catheter ablation vs electrophysiologically guided thoracoscopic surgical ablation in long-standing persistent atrial fibrillation: The CASA-AF study. *Heart Rhythm* 2017;14:1596-1603.

Tools and techniques for catheter ablation of atrial fibrillation (AF) continue to improve, and the procedure consistently outperforms antiarrhythmic drug therapy across many populations. Results are best for patients with paroxysmal AF, in which episodes terminate spontaneously or with intervention within seven days of onset. In the 2017 HRS/EHRA/ECAS/APHRS/SOLAECE Consensus Statement, catheter ablation is a class I recommendation (Level of Evidence A) for treatment of symptomatic, paroxysmal AF in patients refractory to or intolerant of at least one antiarrhythmic medication and a class IIa recommendation prior to drug therapy. Long-standing, persistent AF (LSPAF, defined as continuous AF > 12 months' duration) is substantially more difficult to control, and single-procedure success rates with catheter ablation often are well below 50%.

Thoracoscopic surgical ablation is a technique for partially reproducing the strategy of the effective open-heart Cox-Maze procedure, but in a less complex, less morbid, minimally invasive way. The authors of CASA-AF recruited 51 patients with LSPAF at one center in the United Kingdom, 25 of whom chose catheter ablation and 26 of whom chose surgical ablation. Relatively extensive catheter ablation was performed in all patients in the first group: pulmonary vein isolation (PVI), plus creation of left atrial roof and mitral isthmus lines, as well as ablation of left atrial complex fractionated electrograms and any sources of inducible atrial tachycardia. Patients in the surgical ablation group underwent bilateral thoracoscopic access, bilateral epicardial pulmonary vein isolation via a bipolar radiofrequency clamp, posterior wall isolation via superior and inferior lines, and ganglionated plexi ablation. In 13 patients, the left atrial appendage also was excluded and amputated. Post-procedure arrhythmia assessment was performed via seven-day continuous ambulatory monitoring at three, six, nine, and 12 months. If the decision was made to proceed with a second procedure for symptomatic recurrence after a three-month blanking period, then only catheter ablation was performed.

Single-procedure freedom from atrial arrhythmia while off antiarrhythmic drugs was significantly higher in the group undergoing surgical ablation (73% vs. 32%). Multi-procedure success off drugs also was higher (77% vs. 60%) but did not reach statistical significance. The incidence of major complications was higher in the surgical ablation group (27% vs. 8%; $P = 0.07$), but there was only one serious adverse event: intracerebral hemorrhage in a patient 60 days after catheter ablation, believed to be unrelated to the procedure. The authors concluded that in patients with LSPAF, an electrophysiologically guided thoracoscopic surgical ablation procedure was superior to the standard catheter approach.

■ COMMENTARY

This is not the first trial comparing catheter ablation with surgical ablation of AF: The authors of the multicenter FAST trial prospectively randomized 124 patients, most with paroxysmal AF and many with prior failed catheter ablation, and showed superior freedom from AF but significantly more adverse events via surgical ablation.[1] However, the population in CASA-AF was exclusively patients with long-standing persistent AF in whom maintenance of durable sinus rhythm off antiarrhythmic drug therapy tends to be particularly difficult. The ability to demonstrate significantly superior AF suppression with thoracoscopic surgical ablation despite such a relatively small cohort is notable, although success rates were not significantly different after multiple procedures.

Patients were not randomized (the authors reported that the patients were given clinical information about both options "without bias"), but, ultimately, groups were fairly well-matched. Patients in the surgical group exhibited a statistically longer duration of continuous AF prior to ablation (a median of 24 months vs. 18 months in the catheter ablation group), although this might be expected to disadvantage surgical ablation, arguably making the actual outcomes that much more noteworthy.

Importantly, the authors introduced a meticulous technique for assuring the desired electrophysiological endpoints were achieved in the surgical ablation group beyond the routine testing performed with the surgical ablation tools. An electrophysiologist independent of the cardiac surgeon used a mobile EP mapping system and a multi-electrode catheter introduced through a thoracoscopic port to guide additional ablation in five of the 22 surgical patients tested. These findings suggest that the chances of long-term success with surgical ablation are improved significantly with formal electrophysiological testing during the procedure, as would be routine during catheter ablation. A major barrier to even minimally invasive surgical ablation remains its associated morbidity. Mean length of hospital stay was a week in the surgical ablation group. That was significantly longer than the 4.1-day hospital stay in the catheter ablation group, although it is unclear why hospitalizations were even that long. In routine clinical practice,

24-hour hospitalizations after catheter ablation are commonplace. Additionally, at least one major complication occurred in seven of the 26 surgical ablation patients, including four significant pulmonary vein stenoses. In contrast, the catheter ablation group had one asymptomatic pulmonary vein stenosis managed conservatively and one case of acute pulmonary edema soon after discharge. Minimally invasive surgical ablation may play an increasingly important role in the treatment of persistent AF, and cardiologists and their patients should be aware of this approach.

Whether the associated risks are justified by the opportunity to avoid multiple catheter procedures to achieve comparable results will be a major question going forward. Further randomized trials are warranted (and ongoing), and a frank discussion of relative risks and benefits will be, as always, critical. ■

REFERENCE

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CME/CE QUESTIONS

1. A strong independent predictor of 90-day mortality in cardiogenic shock is:

a. baseline alanine aminotransferase (ALT).

b. ALT at 24 hours.

c. > 20% rise in ALT in the first 24 hours.

d. > 50% rise in ALT at 12 hours.

2. In acute myocarditis patients with normal hemodynamics and left ventricular ejection fraction, which late gadolinium enhancement (LGE) cardiac magnetic resonance imaging pattern carries the worst prognosis?

a. Anteroseptal midwall

b. Inferolateral subepicardial

c. No LGE

d. Apical only

3. A study comparing thoracoscopic surgical ablation of persistent atrial fibrillation (AF) to standard catheter ablation showed statistically better:

a. initial freedom from AF recurrence.

b. freedom from AF recurrence after multiple procedures.

c. increased major complications with surgery.

d. Both a and c

4. Which commonly used drugs increased the frequency of major bleeding with use of the new oral anticoagulants in patients with non-valvular AF?

a. Amiodarone

b. Fluconazole

c. Phenytoin

d. All of the above

5. A recent trial in chronic stable angina patients with single-vessel coronary artery disease comparing percutaneous coronary intervention to a sham procedure showed:

a. improvement in the fractional flow reserve of the lesion treated.

b. improvement in the lesion associated wall motion abnormality on dobutamine stress echo.

c. improvement in angina symptoms.

d. Both a and b

CME/CE OBJECTIVES

Upon completion of this educational activity, participants should be able to:

- discuss the most current information related to cardiac illness and the treatment of cardiac disease;
- explain the advantages and disadvantages, as well as possible complications, of interventions to treat cardiac illness;
- discuss the advantages, disadvantages, and cost-effectiveness of new and traditional diagnostic tests in the treatment of cardiac illness; and
- discuss current data regarding outpatient care of cardiac patients.