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Clinical Cardiology [ALERT]

Critical analysis of the latest clinical research in cardiovascular medicine

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ABSTRACT & COMMENTARY

How Much Might the Ejection Fraction Improve? Predicting Response to Premature Ventricular Complex Ablation

By Joshua D. Moss, MD

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

SYNOPSIS: Several echocardiographic and electrocardiographic features were identified that can help predict if a cardiomyopathy is caused purely by frequent premature ventricular complexes and whether left ventricular function will normalize with ablative therapy.

SOURCE: Penela D, Fernández-Armenta J, Aguinaga L, et al. Clinical recognition of pure premature ventricular complex-induced cardiomyopathy at presentation. *Heart Rhythm* 2017; Jul 27. pii: S1547-5271(17)30893-7. doi: 10.1016/j.hrthm.2017.07.025. [Epub ahead of print].

Frequent premature ventricular complexes (PVCs) can both independently cause a cardiomyopathy and worsen an existing cardiomyopathy. In patients with normal left ventricular (LV) function and frequent PVCs, several factors have been identified as possible predictors of future cardiomyopathy, including higher PVC burden, longer PVC-QRS duration, non-sustained ventricular tachycardia (VT), and presence of multiple PVC morphologies. In patients with cardiomyopathy caused "purely" by frequent PVCs, LV function often recovers completely after successful suppression of the PVCs with catheter ablation. In contrast, LV function may improve only partially or minimally if the PVCs are merely worsening a nonischemic cardiomyopathy with another principal etiology.

In this prospective study at five centers, Penela et al sought to determine what characteristics could predict which patients would gain complete recovery of LV function with successful PVC ablation. Over a 5.5-year period, 105 patients with a PVC burden > 4% on 24-hour Holter monitoring, LV ejection fraction < 50% that was not known to pre-date the

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diagnosis of PVCs, and no evidence of ischemic heart disease underwent catheter ablation after at least three months of guideline-directed medical therapy. Acute success was achieved in 93 (89%), with sustained success through 12 months of follow-up in 74 (71%). All patients with sustained successful reduction in PVC burden by at least 80%, as well as those with partial suppression but complete recovery of LV function, were included in the analysis.

There were two independent predictors of any significant echocardiographic response to PVC ablation: shorter sinus rhythm QRS duration and larger baseline PVC burden (with a pre-ablation burden > 12% conferring 98% sensitivity and 90% specificity for response). About half the patients demonstrated complete normalization of LV function with sustained or partial suppression of PVCs and were deemed to have a "pure" PVC-induced cardiomyopathy. Findings independently associated with such a cardiomyopathy included shorter sinus rhythm QRS duration and PVC-QRS duration, higher PVC burden (with a pre-ablation burden > 17% conferring 97% sensitivity and 78% specificity for the diagnosis), and smaller LV end-diastolic and end-systolic diameters. An algorithm was derived to distinguish patients prior to therapy: The presence of an intrinsic QRS > 130 msec, baseline PVC burden < 17%, or LV end-diastolic dimension > 63 mmHg was predictive of PVC-worsened cardiomyopathy, while the absence of all three suggested a pure PVC-induced cardiomyopathy with 85% sensitivity and 98% specificity.

■ COMMENTARY

This study provides more information for cardiologists to use in identifying cardiomyopathy patients who could benefit most from additional ambulatory ECG monitoring and referral for ablative therapy. By evaluating a relatively simple set of parameters that typically are collected during routine evaluation of cardiomyopathy, clinicians can give a better explanation of the potential effect of PVC ablation (particularly when the PVCs themselves are not very symptomatic). More meaningful long-term prognoses can be discussed, and primary prevention ICD implantation may be delayed successfully or deferred completely.

One could argue that incomplete recovery of LV systolic function after successful PVC ablation does not rule out the possibility that some irreversible structural disease has developed purely because of long-standing PVCs. In fact, one patient of 13 who exhibited complete normalization in ejection fraction and followed longer than 12 months eventually developed worsening LV function again. However, the definition of a "pure" PVC-induced cardiomyopathy is largely semantic. What the authors effectively have described is a means of predicting complete recovery, with the best prognosis conferred by narrow sinus QRS, PVC burden > 17%, and non-dilated LV.

Equally interesting are those factors that were not predictive. Older age did not confer a lower likelihood of pure PVC-induced cardiomyopathy and probability of complete recovery with ablation; neither did lower LV ejection fraction. Whereas older patients with severely decreased LV systolic function instinctively might seem to carry a poorer prognosis, their chance for recovery with PVC ablation may be as good as everyone else's. The absence of pathological late gadolinium enhancement on cardiac MRI also may help predict recovery, although this study likely was underpowered when it comes to answering that question.

One management option not addressed is antiarrhythmic drug therapy, and whether PVC suppression with medications could confer the same benefits as successful catheter ablation. Many cardiologists and patients may be more comfortable with non-invasive therapies without associated procedural risks. Nevertheless, PVC ablation has been shown in multiple studies to be both safe and effective, and antiarrhythmic drugs (particularly amiodarone) are by no means risk-free. Notably, in the present study, procedure-related complications were infrequent, including one femoral pseudoaneurysm and two pericardial effusions (none required surgical intervention). Patients undergoing evaluation and treatment for cardiomyopathy should be considered

for ambulatory ECG monitoring to assess PVC burden, particularly if they exhibit any ectopy on a routine 12-lead ECG or suggestive symptoms. Referral to an electrophysiologist for discussion of the relative risks and benefits of antiarrhythmic drug therapy vs. catheter ablation is appropriate for any cardiomyopathy patient with > 5-10% PVC burden, and especially if a pure PVC-induced cardiomyopathy is identified using the criteria above. ■

ABSTRACT & COMMENTARY

Percutaneous Coronary Interventions in Nonagenarians

By Michael Crawford, MD, Editor

SYNOPSIS: Nonagenarians can undergo percutaneous coronary interventions with low in-lab complication rates, but 30-day and one-year mortality is considerably higher than in younger patients.

SOURCES: Sawant AC, Josey K, Plomondon ME, et al. Temporal trends, complications, and predictors of outcomes among nonagenarians undergoing percutaneous coronary intervention: Insights from the Veterans Affairs Clinical Assessment, Reporting, and Tracking program. *JACC Cardiovasc Interv* 2017;10:1295-1303.

Holmes DR Jr. Four score and 10 years. *JACC Cardiovasc Interv* 2017;10:1304-1306.

As longevity increases, more patients ≥ 90 years of age are presenting for percutaneous coronary interventions (PCI), especially since coronary bypass surgery is less attractive in these patients. However, there are little data in clinical trials concerning this age group. Investigators used the national database of the Veterans Affairs (VA) Clinical Assessment, Reporting and Tracking (CART) program to determine the prevalence of nonagenarians undergoing PCI between 2005-2014, and their clinical characteristics and PCI complications, compared to younger patients. CART identified 67,148 veterans who underwent PCI during these 10 years. The National Cardiovascular Data Registry (NCDR) Cath PCI score was evaluated for risk stratifying nonagenarians. Also, the authors used a multivariable frailty model to adjust the one-year mortality data. Any patients who died < 30 days after PCI were excluded from the one-year data. Of the 67,148 patients, 804 were nonagenarians (1.2%) and of these, 274 (34%) had PCI. Most of the patients were male (98%) and Caucasian (81%). Compared to younger veterans, the nonagenarians had a lower body mass index and were less likely to be smokers, diabetics, or have family history of coronary artery disease. They were more likely to suffer from hypertension, systolic heart failure, cardiovascular disease, and chronic kidney disease. They also were more likely to experience acute coronary syndrome, cardiogenic shock, or renal failure on presentation. After PCI, nonagenarians were more likely to develop acute cardiogenic shock (0.73% vs. 0.12%; $P = 0.04$) and no reflow (2.9% vs. 1%; $P = 0.02$). The 30-day post-PCI mortality was higher than in younger patients (10.6% vs. 1.4%; $P < 0.0001$) as was adjusted one-year mortality (16.2 vs. 4%; $P < 0.0001$). Also, the adjusted 30-day mortality hazard ratio (HR) was 2.14 (95% confidence interval [CI], 1.42-3.22) and one-year mortality HR was 1.82 (95% CI, 1.27-2.62). The NCDR Cath PCI risk score was highly predictive of both 30-day (HR, 2.29; 95% CI, 1.86-2.82) and one-year mortality (HR, 1.43; CI, 1.07-1.9). The authors concluded that nonagenarians are a small but growing proportion of PCI patients who experience worse outcomes, and the NCDR Cath PCI risk score is an excellent predictor of mortality in these patients.

■ COMMENTARY

As a general cardiologist, I have noticed an increasing number of nonagenarians presenting with acute coronary syndromes, usually non-ST elevation myocardial infarction, who potentially could benefit from PCI. Because of comorbidities, they often are not good candidates for bypass surgery. Family members, who often are enthusiastic about PCI, push their loved ones toward more aggressive management short of surgery. However, once coronary angiography reveals severe calcific three-vessel disease, our enthusiasm wanes, but we usually push on with the PCI. Unfortunately, the outcomes after PCI are not always good in this group, and we wonder if we did the right thing. When we go to the guidelines or the randomized trial data, we don't find much to help us. Consequently, this study was of great interest to me.

This study confirmed my experience and observational reports that the number of nonagenarians presenting with coronary artery

disease is increasing. The number of such patients doubled in this study between 2010 and 2014, and it confirmed that PCI can be performed with a low in-lab complication rate. They reported no myocardial infarctions, strokes, tamponade, or perforations in the lab. Also, they confirmed a higher mortality rate post-PCI but less than some studies have reported. This suggests that 21st century VA cardiac care is quite good. What is new about this report is the demonstration of the predictive ability of the NCDR Cath PCI risk equation, which uses the following variables: age, cardiogenic shock, heart failure, vascular disease, chronic lung disease, glomerular filtration rate, New York Heart Association class, and PCI characteristics to estimate mortality. In this study, the survival at 30 days and one year was particularly poor in the highest risk quartile of patients (score of 40-95 points). Also, none of the nonagenarians who presented in cardiogenic shock survived 30 days. Although the NCDR Cath PCI score should be tested prospectively, it gives clinicians some guidance on who is at highest risk and confirms the futility of PCI in nonagenarians who present in cardiogenic shock.

This study has limitations. One big one is that involves only those sent to PCI; there is no conservative therapy comparison group. Also, most nonagenarians are women, yet this is largely a study of men. There was little use of fractional flow reserve (< 4%), and we are not provided with coronary anatomic data. Despite these limitations, I believe this study will aid me in decision-making regarding nonagenarians presenting with coronary disease. ■

ABSTRACT & COMMENTARY

Frailty as a Patient Assessment Tool Prior to Aortic Valve Replacement

By Jeffrey Zimmet, MD, PhD

Associate Professor of Medicine, University of California, San Francisco; Director, Cardiac Catheterization Laboratory, San Francisco VA Medical Center

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

SYNOPSIS: Assessment of frailty adds important prognostic information about risk of death and disability following both surgical aortic valve replacement and transcatheter aortic valve replacement. Among the available instruments for assessing frailty, a scale known as the Essential Frailty Toolkit demonstrated the best correlation with outcomes.

SOURCE: Afilalo J, Lauck S, Kim DH, et al. Frailty in older adults undergoing aortic valve replacement: The FRAILTY-AVR study. *J Am Coll Cardiol* 2017;70:689-700.

As the options for treating aortic stenosis by surgical and transcatheter procedures have increased, assessment of patients' suitability for the procedure and subsequent prognosis has become more complex. Tools such as the Society of Thoracic Surgeons (STS) risk score and EuroSCORE are highly useful in predicting short-term risk of surgical aortic valve replacement (SAVR), but these instruments neglect many important details and are not validated for predicting outcomes for transcatheter aortic valve replacement (TAVR). Among the unmeasured variables is frailty, which carries great intuitive appeal in this realm, but clinicians have used it on a limited basis. Reasons for this restrained uptake include the time and effort involved in performing the various tests and, more importantly, a lack of consensus on which tools should be used to measure frailty. Although gait speed as a single measure has been the most commonly used test, multi-domain frailty scales are preferred to achieve higher degrees of specificity for clinical outcomes. Most of these scales have been validated in individual studies, but head-to-head comparisons are lacking.

Accordingly, Afilalo et al presented the results of the FRAILTY-AVR study, which sought to prospectively evaluate the value of seven different frailty assessment tools in predicting outcomes in patients undergoing SAVR and TAVR. For the trial, patients > 70 years of age anticipating SAVR or TAVR were enrolled at 14 centers in Canada, the United States, and the Netherlands. Data were collected, and frailty was assessed by trained individuals using the Fried, Fried+, Rockwood, Short Physical Performance Battery, Bern, Columbia, and the Essential Frailty Toolset (EFT). The primary outcome measure was all-cause death at one year, with secondary outcomes of death at 30 days and a composite of death and increased disability at 12 months. Over the five-year study period, 1,020 older adults were enrolled, of

whom 646 underwent TAVR and 374 underwent SAVR. The median age was 82 years, and the average STS score (predicted risk of mortality) was 4.3% (5.4% in the TAVR group, and 2.7% in the SAVR group). Notably, although frailty was assessed by these tools on a scale from least to most frail, it was reported as a dichotomous variable; patients were either judged to be frail or not. Frailty was approximately two-fold higher among TAVR patients compared to SAVR patients.

As expected, frailty was predictive of hard outcomes, with substantial variability among the different scales. The results showed that the EFT frailty assessment outperformed the other scales and was most strongly associated with one-year mortality, with an odds ratio of 3.72. The EFT also was the strongest predictor of death at 30 days and of worsening disability at one year. Further, it added incremental value to prediction models using the STS predicted risk of mortality score and procedure type in terms of predicting these hard outcomes.

The authors concluded that frailty is a strong predictor of mortality and disability following both SAVR and TAVR. Among available tools, the EFT demonstrated the most robust performance characteristics regarding predicting poorer outcomes following AVR.

■ COMMENTARY

Frailty as a concept in assessing patients for outcomes after cardiovascular interventions is intuitive and appealing, but in practice its measurement has been challenging to operationalize. The large number of measurement tools, some of which are challenging and time-consuming to administer, has led to confusion over the very definition of frailty, and has hampered its uptake as a clinical tool. In FRAILTY-AVR, the prevalence of frailty varied between 26% and 68%, depending on the particular tool used. This is a striking amount of variability, which highlights the need for this study. The tool that outperformed the others, EFT, is a relatively simple four-element, 5-point scale. Patients are scored for time to stand five times from a seated position (1 point if ≥ 15 seconds, 2 points if unable to complete), cognition (1 point for Folstein Mini-Mental State Examination [MMSE] score < 24), hemoglobin (1 point if < 13 g/dL in men or < 12 g/dL in women), and serum albumin (1 point if < 3.5 g/dL). Patients with ≥ 3 points are deemed frail, while 5/5 points defines severe frailty. The tests can be conducted easily and fairly rapidly (the most time-consuming part of the exam is the MMSE) in the office environment, and inter-observer variability is relatively low.

Assessment of older patients with severe aortic stenosis increasingly involves not just the choice of treatment modality (SAVR vs. TAVR), but also the determination in some patients about whether to treat. In this study, although procedural success was very high and short-term outcomes were good, the incidence of death or marked disability at one year was more than one-third for the whole group of patients. For those deemed frail by the EFT, the number was > 50%, while for those marked as severely frail (5 out of 5 points), 80% were dead or disabled at one year. These are sobering numbers.

With a relatively straightforward and validated tool, the assessment of frailty takes its rightful place as a central component in the evaluation of older adults with severe AS. Along with defining which patients are likely to benefit from AVR procedures, frailty assessment can assist in determining which patients are less likely to receive full benefit, either because they are unlikely to survive past one year, or because they will experience increased disability or worsened quality of life. Ultimately, patients and their families will benefit from this receiving this information as part of a shared decision-making process, as well as elements of informed consent. ■

ABSTRACT & COMMENTARY

Palliative Care-based Intervention Improves Quality of Life in Chronic Heart Failure

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: Among patients with advanced heart failure, implementation of an interdisciplinary palliative care intervention was associated with improved quality of life.

SOURCE: Rogers JG, Patel CB, Mentz RJ, et al. Palliative care in heart failure: The PAL-HF randomized, controlled clinical trial. *J Am Coll Cardiol* 2017;70:331-341.

Advanced heart failure (HF) is associated with substantial morbidity, mortality, and reduced quality of life (QOL). Standard therapies focus on slowing disease progression and improving survival but do not address patient suffering. Palliative care has been shown to improve QOL among patients with cancer and may be helpful in those with advanced HF.

The Palliative Care in Heart Failure (PAL-HF) trial randomized patients with advanced HF and a high predicted six-month mortality to usual care (UC) alone or UC with an additional palliative care intervention (UC+PAL). The palliative care intervention was led by a nurse practitioner who assessed and managed multiple domains of QOL, including physical symptoms, psychosocial and spiritual concerns, and advance care planning. The nurse practitioner worked with a palliative medicine physician in close collaboration with the advanced HF clinic. Nearly all patients were enrolled during an HF hospitalization and subsequently followed in the outpatient setting for six months. The two co-primary endpoints were validated measures of HF-specific QOL and general and palliative care-specific, health-related QOL.

A total of 150 patients were randomized, with an average age of 71 years. Most patients exhibited New York Heart Association Functional Class III symptoms. Over six months of follow-up, patients randomized to UC+PAL saw significantly greater improvement in measurements of HF-specific QOL ($P = 0.03$) as well as palliative care-specific QOL ($P = 0.035$). Compared to those randomized to UC alone, patients receiving the palliative care intervention also demonstrated significantly greater improvement in depressive symptoms ($P = 0.02$), anxiety ($P = 0.048$), and spiritual well-being ($P = 0.03$). There were no significant differences in re-hospitalization rate or mortality. The authors concluded that an interdisciplinary palliative care intervention improves health-related QOL in advanced HF patients and represents an important component of the holistic care of these patients.

■ COMMENTARY

Incorporating palliative care into the management of chronic HF receives a class I recommendation in current HF practice guidelines. However, the evidence supporting the use of palliative care in HF is sparse. PAL-HF is the first randomized, controlled trial of a palliative care intervention in advanced HF and shows clear improvements in a wide range of patient-reported outcomes, including QOL, depression, anxiety, and spiritual well-being.

PAL-HF is an important study for many reasons, particularly the focus on endpoints not usually studied in HF clinical trials. Although reducing hospitalizations and mortality are important goals, measures of suffering and QOL may be more important to some patients and are inadequately assessed with the current treatment approach.

The primary limitation of this study is its single-center design. All patients were followed at Duke University Medical Center, a large academic hospital with access to resources not always available in the community. With 5.7 million Americans living with HF, one major limitation of any plan to expand access to palliative care programs is availability of palliative care specialists. Comprehensive, longitudinal follow-up similar to what was implemented in PAL-HF just may not be feasible in many areas of the country. That said, one major strength of this study is the use of a nurse practitioner as the team leader. When faced with the current nationwide shortage of palliative care physicians, shifting care to other members of the healthcare team may help scalability of palliative care-focused interventions. For many HF patients, the important job of implementing palliative care ultimately will fall on cardiologists and other providers already caring for them. Therefore, palliative care will have to fit into already-full clinic visits. With that in mind, another limitation of PAL-HF is that we don't know exactly which components of the palliative care intervention are most effective in HF patients. The multicomponent program implemented in PAL-HF is likely too complex for the average cardiologist. Hopefully, future studies will help clarify exactly which components are most beneficial to patients with advanced HF.

For now, providers caring for patients with advanced HF should try to incorporate principles of palliative care into their practice to the extent possible. This will require basic training in palliative care for cardiologists and other providers who care for patients with HF. Those who do not feel comfortable implementing palliative care and do not have access to palliative care specialists should consider referral to a HF specialty center for patients with advanced disease who are not responding to guideline-based therapies. ■

ABSTRACT & COMMENTARY

Does Celecoxib Pose Greater Cardiovascular Risks Than NSAIDs?

By Michael Crawford, MD, Editor

SYNOPSIS: A controlled trial that included patients with arthritis on nonsteroidal anti-inflammatory drug (NSAID) therapy who were randomized to continuing NSAIDs or switching to celecoxib showed that cardiovascular and gastrointestinal event rates are low and not different on the two therapies.

SOURCE: MacDonald TM, Hawkey CJ, Ford I, et al. Randomized trial of switching from prescribed non-selective non-steroidal anti-inflammatory drugs to prescribed celecoxib: The Standard care vs. Celecoxib Outcome Trial (SCOT). *Eur Heart J* 2017;38:1843-1850.

COX-2 inhibitors such as celecoxib have a lower risk of bleeding events than nonsteroidal anti-inflammatory drugs (NSAIDs) but have been associated with higher risks of cardiovascular (CV) events.

However, celecoxib is more potent for relieving symptoms in patients with arthritis. Investigators from Europe conducted the Standard Care vs. Celecoxib Outcome Trial, a prospective, randomized, open-label, blinded outcome evaluation study designed to compare CV and gastrointestinal (GI) safety of continuing NSAIDs compared to switching to celecoxib in patients with osteoarthritis or rheumatoid arthritis.

The patients were > 60 years of age and free from significant CV disease. The primary endpoint was the composite of acute coronary syndrome, stroke, or CV death. Between 2008 and 2013, 7,297 patients across nine trial centers in three countries and 706 primary care practices were randomized and followed for a median of three years. Osteoarthritis was present in 94%. About 70% were taking either diclofenac or ibuprofen. The primary endpoint occurred in 278 patients (4%): 125 on celecoxib and 124 on NSAIDs, which was statistically non-inferior for celecoxib CV outcomes. More serious GI adverse events were reported on NSAIDs (1.8 vs. 1.0%; $P = 0.007$), but more patients on celecoxib withdrew from treatment (51% vs. 30%; $P < 0.0001$).

The most common reason for withdrawal from celecoxib treatment was lack of efficiency (23%). The mortality rate was not significantly different between the two therapies (35 celecoxib patients vs. 41 NSAID patients).

The authors concluded that in patients > 60 years of age who were free from CV disease and taking NSAIDs for arthritis, there was no advantage in switching to celecoxib.

■ COMMENTARY

This study has three important conclusions. First, GI and CV event rates on NSAIDs or celecoxib were low. Second, CV and GI event rates were not significally different between the two therapies. Third, serious adverse events also were not different between the two therapies. In fact, CV event rates were lower than expected overall (0.9%) compared to an expected rate of > 2% in older subjects without overt CV disease, but many with risks factors for it.

Prior studies reporting higher CV event rates on celecoxib were either observational or randomized, controlled trials of short duration. Also, since these prior studies, CV event rates in Europe and the United States have been decreasing, perhaps because of better risk factor control and other prophylactic therapy. Additionally, concomitant proton pump inhibitor therapy has been recommended for those on long-term NSAIDs, and 38% of the subjects in this trial took them. This may explain the low evidence of GI side effects. However, the doses of all study drugs were relatively low compared to the doses used in previous studies and those recommended for osteoarthritis therapy.

There are several caveats. Enrollment was slower than anticipated, perhaps because of the adverse publicity about NSAIDs and COX-2 inhibitors regarding CV events. Consequently, the investigators had to extend the duration of the study to achieve adequate power for the outcomes of interest. Also, withdrawal rates were high, especially for those on celecoxib.

The most common reason for stopping celecoxib was lack of efficiency. This could be because of the relatively low doses deployed (mean 170 mg per day compared to the minimum recommended dose of 200 mg daily). However, the withdrawal rates were similar to rates seen in other studies. Thus, there is no compelling reason to routinely switch patients with arthritis from NSAIDs to celecoxib. ■

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CME/CE QUESTIONS

1. Which of the following frailty indices best predicted one-year disability or death in patients undergoing aortic valve replacement?

a. Fried

b. Rockwood

c. Short Physical Performance Battery

d. Essential Frailty Toolset

2. Which of the following is *not* predictive of a frequent premature ventricular complex (PVC)-induced cardiomyopathy?

a. Left ventricular ejection fraction < 30%

b. PVC burden > 17% on ambulatory ECG monitoring

c. Intrinsic QRS duration < 130 msec

d. Left ventricular end-diastolic dimension < 63 mmHg

3. Percutaneous coronary intervention (PCI) in nonagenarians is associated with a higher rate of:

a. acute cardiogenic shock.

b. 30-day post-PCI mortality.

c. one-year post-PCI mortality.

d. All of the above

4. In older patients taking nonsteroidal anti-inflammatory drugs for arthritis, switching to celecoxib results in:

a. more adverse cardiovascular events.

b. more serious gastrointestinal events.

c. fewer patients continuing treatment.

d. All of the above

5. For chronic severe heart failure patients, palliative care can improve:

a. mortality.

b. quality of life.

c. hospital readmission.

d. All of the above

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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.